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Volume 50, No. 18

Contents—Page 7

•

OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

# AMERICAN DYESTUFF REPORTER

## TEXTILE WET-PROCESSING

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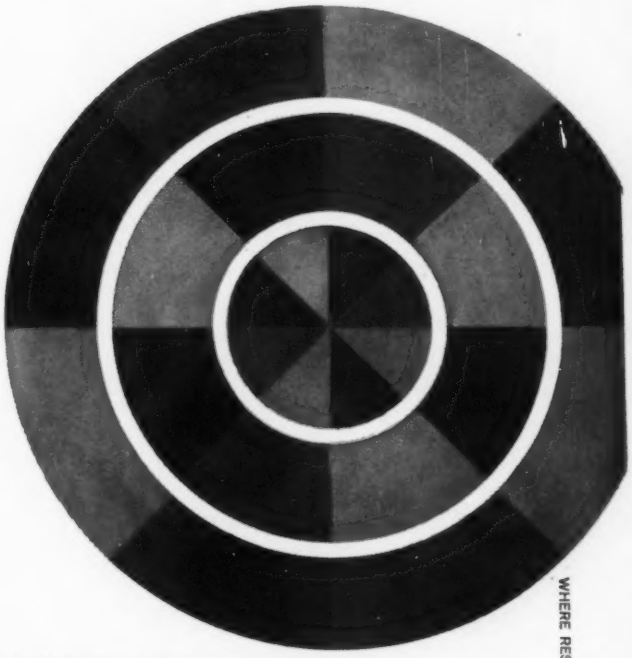

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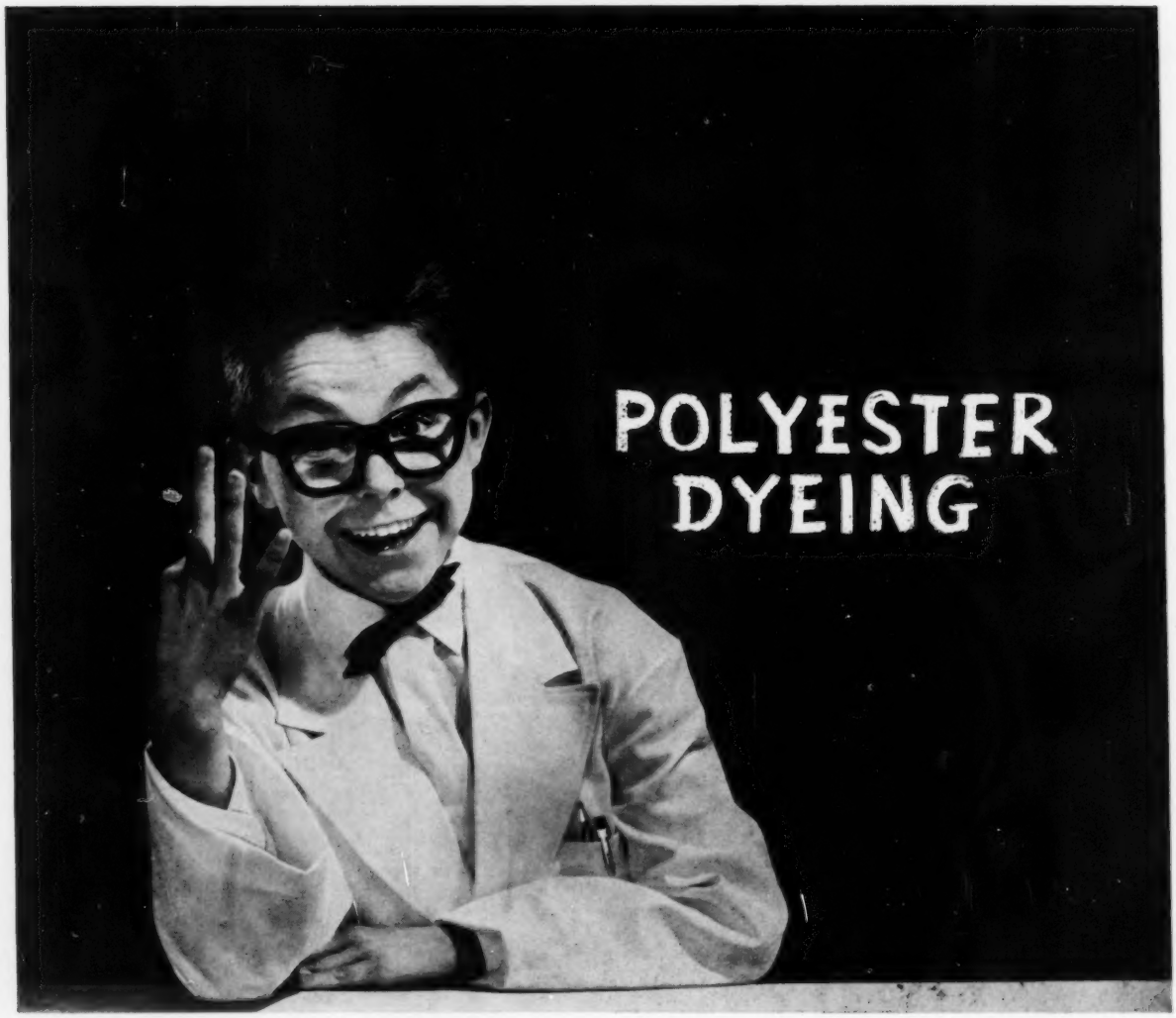


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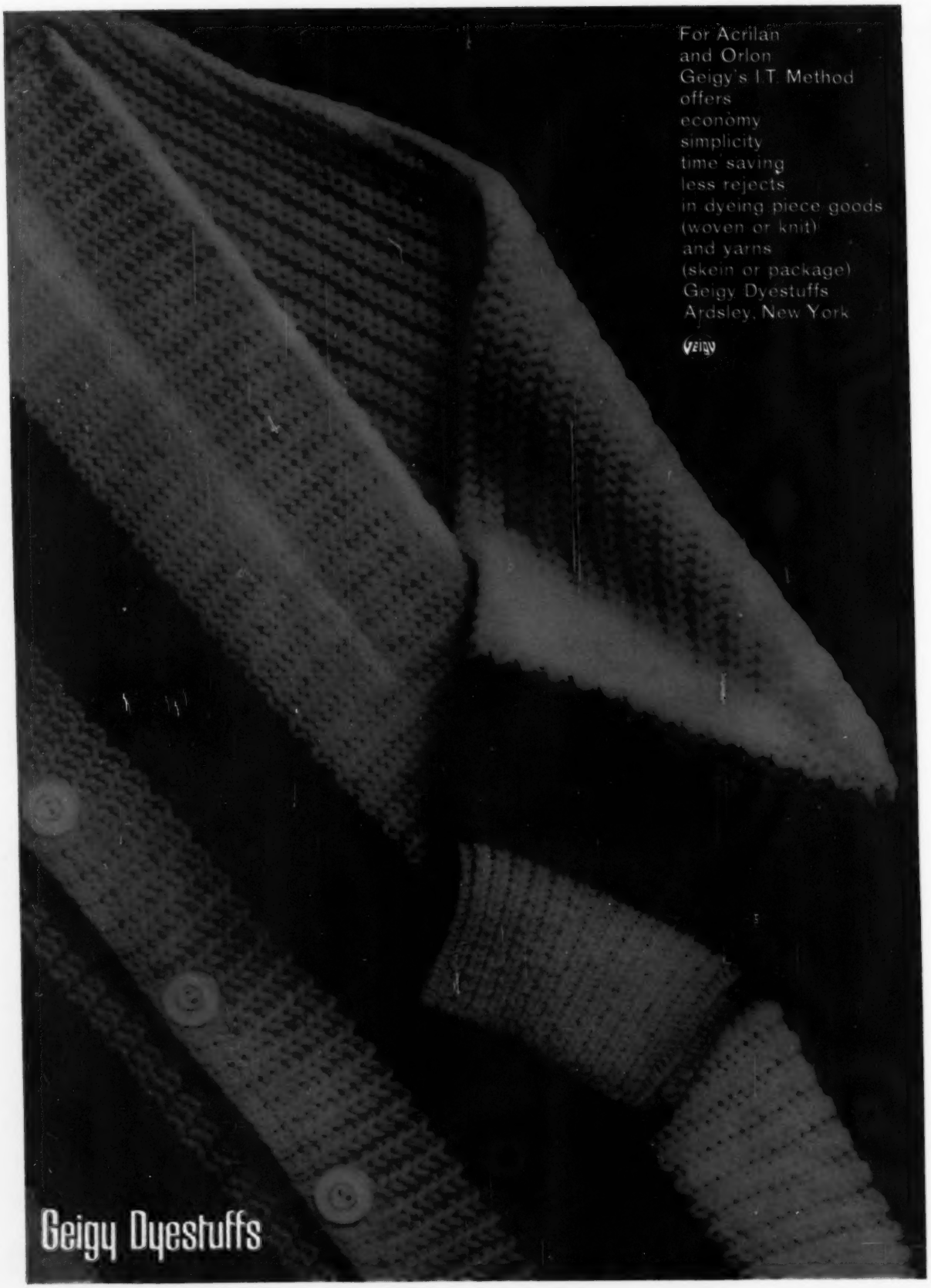
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## specially contributed

Critical Survey of Detergent Literature ..... 17 (660)
Kurt A Schoenberg
Effect of Yarn Twist and Fabric Cover Factor on Crease Recovery and Tear Strength ..... 24 (667)
P B Upadhyay, J R Modi and P C Mehta

## aatcc proceedings

Committee on Wash and Wear Broadens Its Test Procedures ..... 34 (P674)
Graham M Richardson
Considerations in the Use of Nonionic Surface-active Agents ..... 39 (P679)
C E Colwell and W E Rixon
AATCC Calendar ..... 38 (P678)
Employment Register ..... 38 (P678)
Membership Applications ..... 42 (P682)
Convention Notes ..... 43 (P684)
Elected to Membership ..... 43 (P684)
Activities of the Local Sections ..... 44 (P684)

## departments

Open Forum ..... 9 (659)
Future Papers ..... 23 (666)
Abstracts ..... 28 (671)
ADR News Report ..... 53 (689)
Book Reviews ..... 59 (692)

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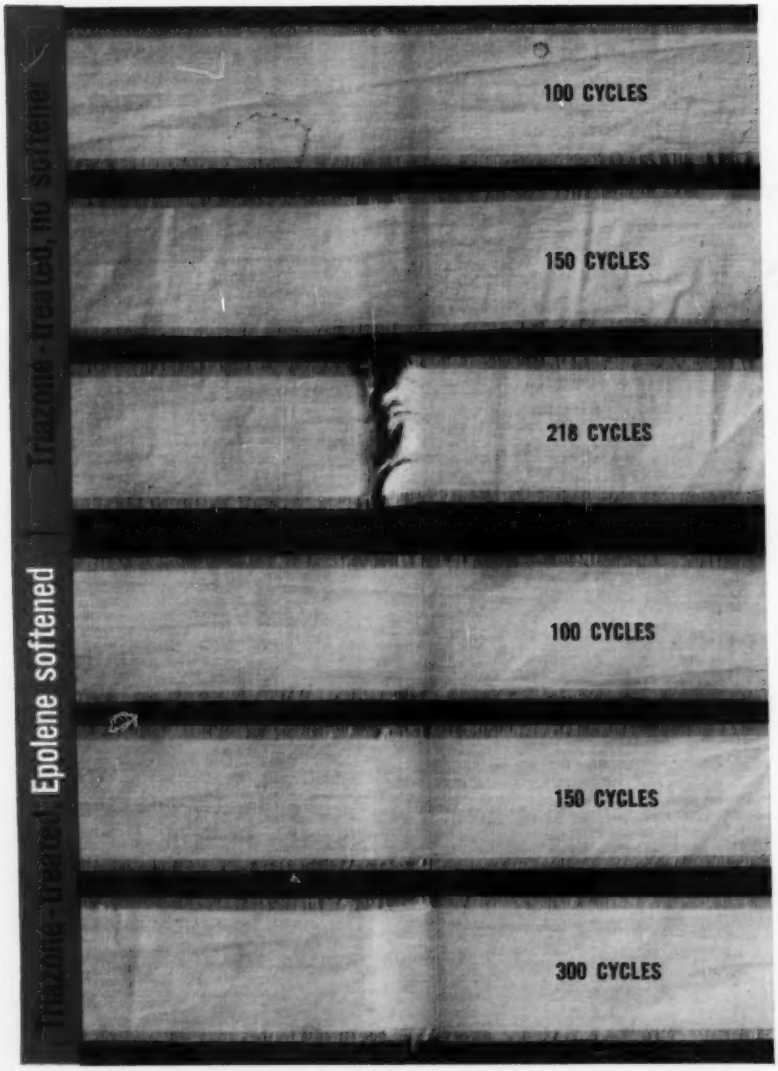
Contents of previous issues can be found by consulting the Service and Technology Index and the Engineering Index, at your library

*The Stoll-Flex Abrasion Test demonstrates the increased strength given to a resin-treated cotton fabric by an Epolene softener.*

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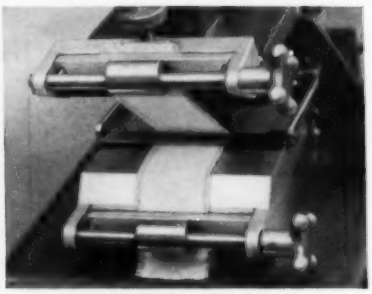

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# ADR OPEN FORUM



## "INTERNATIONAL TEXTILE TECHNOLOGY —KEY TO PROGRESS"

ONE must agree that the theme of the 1961 Convention of the American Association of Textile Chemists and Colorists during this, its 40th anniversary year, is especially appropriate.

Not only the setting for the Convention, which will be held in Buffalo, NY, in the historic Niagara Frontier area which we share with our good neighbor to the north, but also the content of the Technical Program, which will be truly international in scope, will serve to make the theme ring true.

The Technical Program will include papers by speakers from Canada, Australia, Switzerland, and the United States; and even the annual Intersectional Technical Paper Competition, known formerly as the Intersectional Contest, will have an international flavor for the first time with the presentation of a "guest" paper from the Canadian Association of Textile Colourists and Chemists.

The 1961 Convention will be unique in the 40-year annals of AATCC in many ways, but perhaps chiefly in the amount of Canadian participation in the event.

Officially, the CATCC has participated in the formulation of the Technical Program to a large extent. Unofficially (for many CATCC members are also members of AATCC, and specifically the Niagara Frontier Section), the CATCC is represented by a large contingent on the executive committee for the Convention.

This seems to be most fitting as the Quebec Section, CATCC, celebrates its Silver Anniversary. The Ontario Section, "the senior partner", is one year older, having celebrated its 25th anniversary last year.

(Histories of both Canadian Sections and the host AATCC section, Niagara Frontier, will be carried in the September 18th issue of *ADR*).

AATCC, conscious of its own 40-year history, will honor its charter members during the annual Awards Luncheon on Thursday, September 28, in the Terrace Room of the Statler-Hilton, headquarters hotel for the Convention.

The list of living Charter Members of AATCC now numbers 48, and it is anticipated that a majority will be in Buffalo at the end of this month.

The tiny Niagara Frontier Section is to be commended for undertaking the host role for this affair. We feel sure that AATCC members as well as many Canadian and overseas guests with an interest in textile technology will support this year's Convention in large numbers.

Full pre-Convention coverage will be included in the next issue of *American Dyestuff Reporter*.

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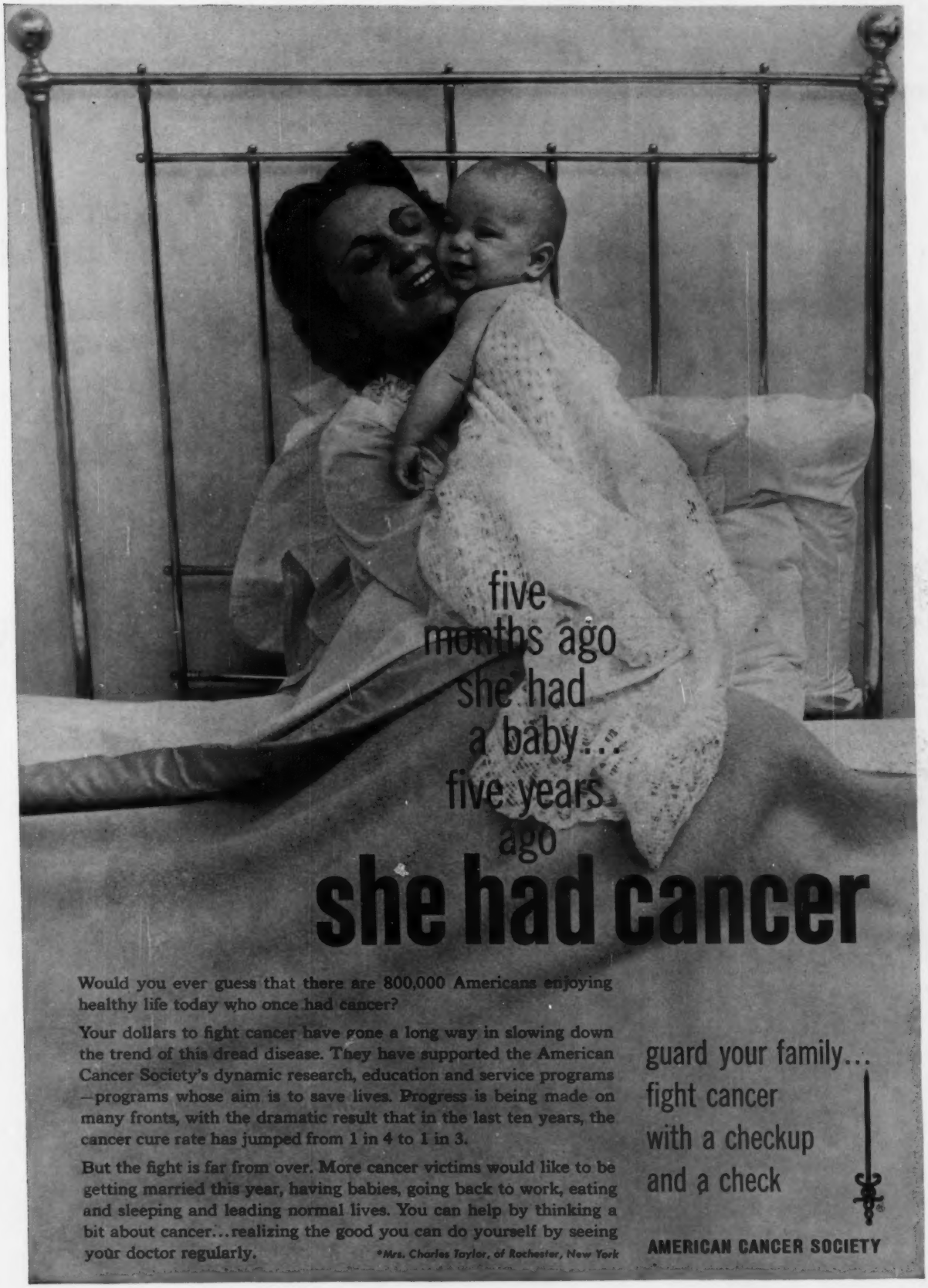
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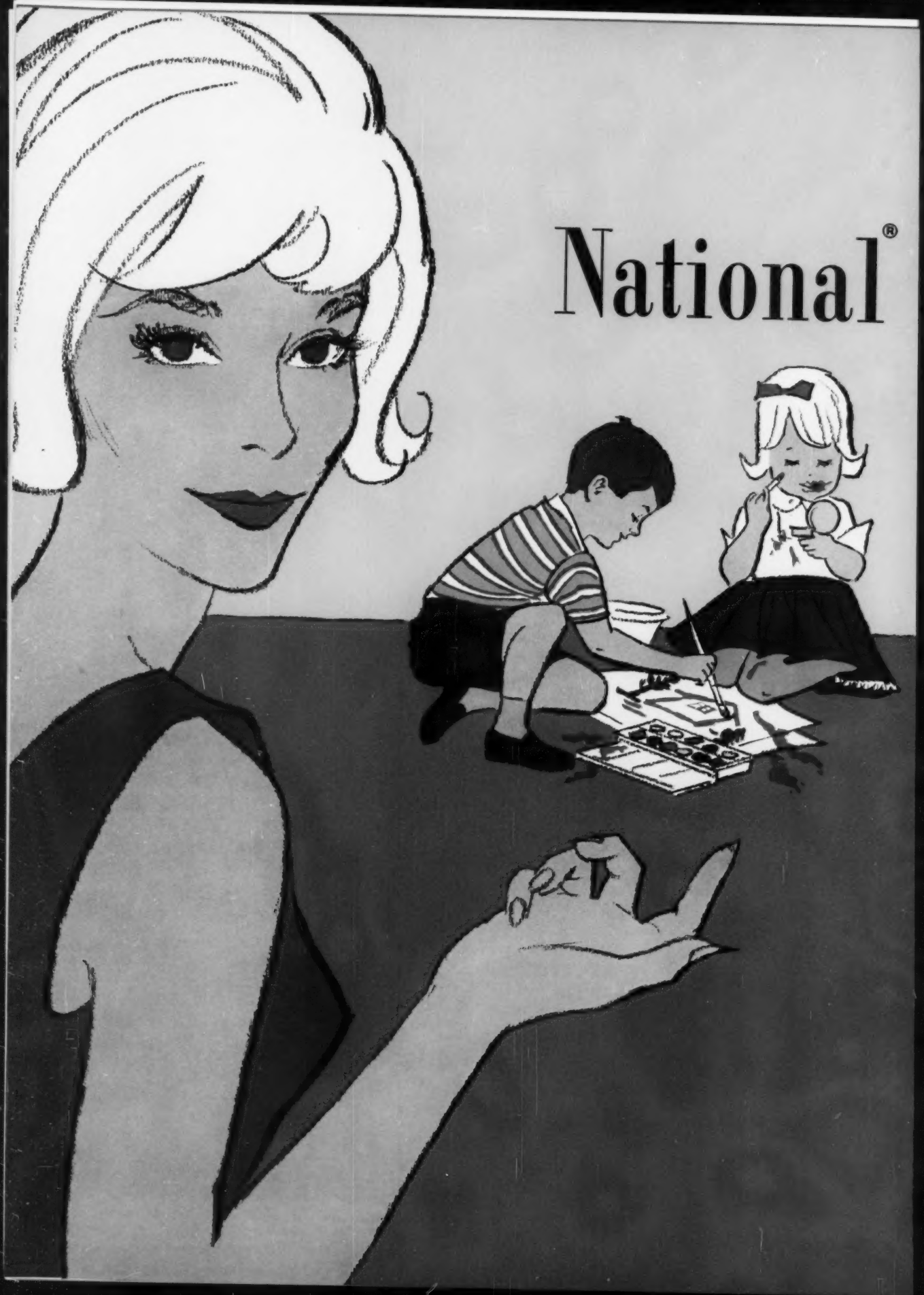
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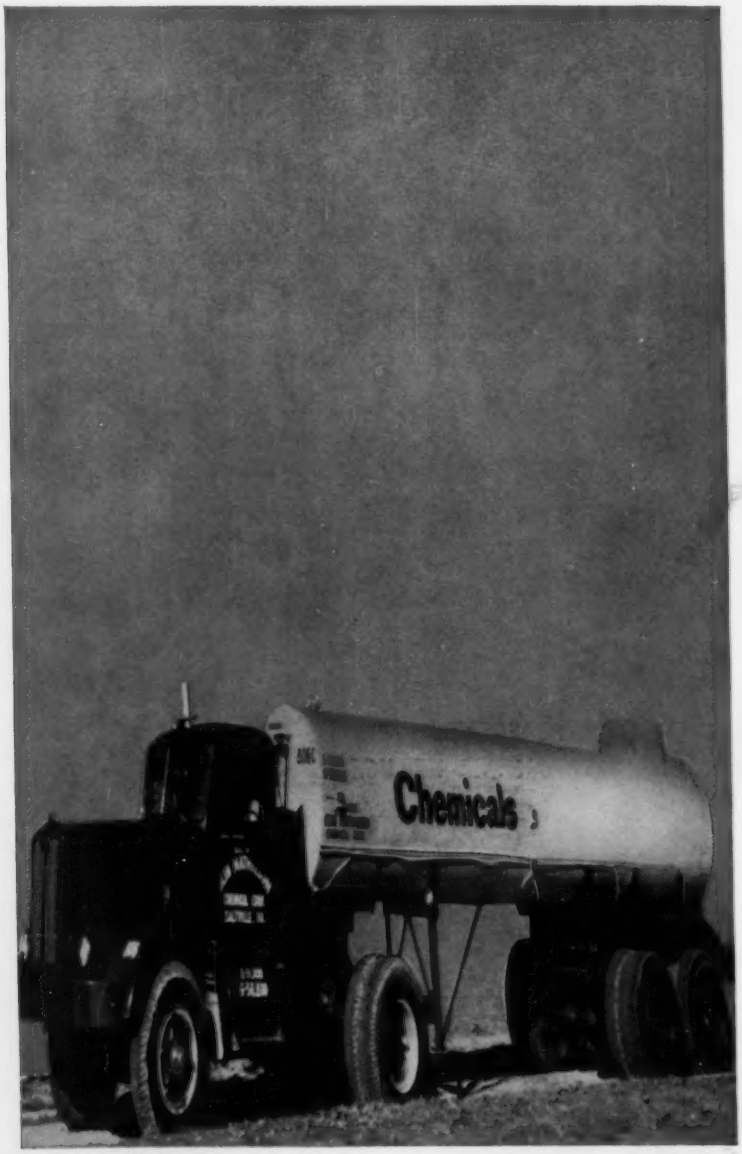


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# CRITICAL SURVEY OF DETERGENT LITERATURE

**KURT A SCHOENBERG**

*The Danish Government Home Economics Council*

*Copenhagen, Denmark*

Most of the reported work on detergency has been carried out with artificially soiled cloth. Although a vast number of different soils have been proposed for this purpose, nearly all of them contain carbon black or similar types of elementary carbon, in most cases mixed with fats and/or proteins and carbohydrates, and normally applied from carbon-tetrachloride suspensions. In some cases an aqueous dispersion has been used.

It appears, however, that these soils do not lead to washing results which can be compared with actual practice. Only a few attempts have been made to simulate natural soil by using synthetic street soil or natural vacuum cleaner dust. Also, the use of soil washed out of cloth during drycleaning has been tried. None of these soils has found much approval.

Quite a number of published papers are concerned with the relation between reflectance and soil-content of the cloth. It seems proved that the so-called Kubelka-Munk equation is not valid for artificially soiled swatches.
The term

$$k \cdot S^n = \frac{q}{(1-q)^2} \qquad \text{or} \qquad k_1 S^n = \frac{R_o - R}{(R - R_\infty)^2}$$

where, normally, $n = 1$, is in close accordance with experimental values.

Also, many formulas have been proposed for the course of the washing time or, in multiple wash series, the number of washes.

Whiteness retention or soil redeposition has been estimated using artificial as well as natural soil. The latter is to be preferred.

## SCOPE

IN the washing department of The Danish Government Home Economics Council a method has been developed for the testing of washing machines (*1*), which is referred to in due course below. It is certainly also a strongly felt desire on the part of the home economics organizations to obtain means for comparing detergent formulations with respect to their properties. Detergency is, no doubt, the most important of these. Hence, starting with the test-method for washing machines, investigations were made to find a method for evaluating detergents. It was quite natural, therefore, to make a survey of the literature in the washing field simultaneously with the first experiments.

In a meeting with leading technical experts from the Danish detergent industry, it was stressed that no reliable methods were available for the evaluation of detergency. It was even expressed by one of them that a reliable test method would be greatly welcomed, but he did not believe that one could be derived within the first 10 or 20 years, if ever.

This view is quite understandable, as none of the methods published in the literature can stand much criticism. On the other hand, the papers contain much interesting and serious work, and since they were rather scattered in different scientific journals, it was decided to gather the results of our literature studies in order to get them published.

An excellent review was made by Sisley in 1943 (*2*). Hence, mainly newer papers are cited here.

No claim, however, is made that the following is a complete survey of everything published in this field. Nevertheless, we hope that it will be useful to the readers.

## SYMBOLS

For the sake of simplicity we will adopt the following symbols throughout this paper irrespective of which other ones might have been used by the authors cited:

| | |
|---|---|
| D | Detergent concentration |
| d | Detergent efficiency |
| f | Mechanical force applied |
| $q = \frac{R_o - R}{R_o - R_\infty}$ | |
| $R_o$ | Reflectance of unsoiled cloth |
| $R_s$ | Reflectance of soiled and unwashed cloth |
| $R_\infty$ | Reflectance of cloth soiled with infinite amount of soil |
| R | Reflectance of soiled and washed cloth |
| $S_s$ | Amount of soil on soiled and unwashed cloth |
| S | Amount of soil on soiled and washed cloth |
| t | Time |
| V | Visual cleanness or relative increase in reflectance |

$$V = \frac{R - R_s}{R_o - R_s} \cdot 100$$

k, $k_1$, $k_2$ ..... constants.

## SOILS

The oldest paper we have found is that of *Shukoff and Schestakoff* (3), who, in a short note to *Chemiker-Zeitung* in 1911, mentioned the use of an artificial soil consisting of lampblack, benzine and lanolin. (See Figure 1). I have not been able to trace the more detailed paper which they promise.

*Heermann* (4) used indigo, *Raaschou & Larsen* (5) fruit juice, and *Madsen* (6) ultramarine, cocoa and iron oxide besides lampblack.

*Rhodes & Brainard* (7) used a soil containing lampblack, lubricating oil and tallow, which was applied dissolved in carbon tetrachloride. The soiled swatches were laundered in a kind of drum-washing machine fitted with an inner cage of rubber-covered wire, and evaluated with the aid of a photometer. These authors already were aware of the aging of their artificially soiled test pieces, ie, the ease of laundering is reduced with time. They therefore carried out all their experiments with swatches aged for 11 hours. Also, they eliminated the influence of the background by measuring the reflectance of samples which were folded in a quadruple layer.

*Vaughn et al* (8, 9, 10) also used a mixture containing carbon black, oil and fat.

*Bacon & Smith* (12, 13) used a mixture of carbon black, oil, fat and starch.

*Harris & Brown* (14, 15) used a mixture of graphite and oil.

*Utermohlen et al* (17, 18) used a black iron oxide pigment instead of carbon in a mixture of fatty materials in order to render it possible to determine the amount of pigment left on the cloth by analysis.

*Koehler* (19) used carbon black or ultramarine dispersed in tallow and mineral oil. He also tried clarete.

A number of artificially soiled fabrics is available commercially, for example:

a Dutch formulation containing carbon black and quartz dispersed in a fatty mixture and printed on the cloth;

the Swiss EMPA material soiled with a suspension of carbon black, olive oil and gum tragacanth in water;

that of Testfabrics Inc, which is imprinted with a dispersion of lampblack in a mainly aqueous oil suspension;

United States Testing Company's standard soiled tissue, prepared with a carbon-black-in-oil mixture, which is dissolved in perchlorethylene.

[The above four soils are cited from a paper by *Vaeck et al* (20)].

Practically all the cloths have been of a plain cotton weave, probably partly because cotton was and still is the most washed textile material, and partly because it presents the greatest difficulties with respect to ease of laundering. *Nutting* (22), however, used a strip of wool. The soiling mixture again was a "conventional" type consisting of 250 g carbon black, 1.9 l fatty oil and 1.9 l mineral oil. It was applied to the wool material before spinning.

*Galbraith* (23) recently reported washing tests on cotton, viscose rayon, wool, nylon, Orlon and Dacron, using heavy duty soaps, h-d low suds synthetics, h-d high suds synthetics, both powders and liquids, unbuilt synthetics and unbuilt cold water synthetics at 70, 100, 120 and 140°F, in hard and distilled water.

All the textile materials were artificially soiled with a graphite/oil mixture. Laundering took place in a

$$V = \frac{R - R_s}{R_o - R_s}$$

**Über die Bestimmung der Waschkraft von Seifen.**

Von Dr. A. A. Shukoff und Dr. P. I. Schestakoff.*)

Die direkte Bestimmung der Waschkraft von Seifen, durch Waschen von schmutziger Wäsche und Vergleich des erzielten Wascheffekts, wurde schon mehrmals von verschiedener Seite versucht, es mangelte aber bis jetzt an einer wissenschaftlich ausgearbeiteten Methode. Die Hauptschwierigkeit bei solchen Versuchen liegt in der Beschaffung von, wenn man sich so ausdrücken kann, homogen schmutziger Wäsche. Um diesem Übelstande abzuhelfen, haben wir versucht, die schmutzige Wäsche künstlich darzustellen, indem wir Baumwollgut mit einer mit Lampenruß versetzten Lösung von Lanolin in Benzin färbten. Wäscht man das auf solche Weise gefärbte Baumwollzeug, in einer Waschmaschine, mit verschiedenen Seifen unter Innehaltung der gleichen Bedingungen von Zeit, Temperatur, Konzentration der Seifenlösung usw., so kann man auf diese Weise den mit verschiedenen Seifen erzielten Wascheffekt bequem vergleichen. Wir behalten uns vor, in einem ausführlicheren Aufsatz später alle die Einzelheiten dieser Versuche auseinanderzusetzen, möchten aber hier nur die Hauptergebnisse kurz erwähnen: 1. Nach der abnehmenden Waschkraft ordnen sich die Seifen folgendermaßen: Talgseifen, Seifen aus flüssigen Pflanzenölen und Olein, Cocos- und Palmölkernseifen, Harzseifen. 2. Die Konzentration der Seifenlösung hat einen großen Einfluß auf die Waschkraft; der beste Effekt wird bei einer 0,2—0,4 %ig (auf Reinseife berechnet) Lösung erzielt. Der Wascheffekt sinkt ebenso bei einer niedrigeren wie auch bei einer höheren Konzentration der Seifenlösung.

Wir beabsichtigen, die Methode auch zu einer quantitativen auszuarbeiten. Wir sind ferner damit beschäftigt, die Waschkraft mit anderen chemischen und physikalischen Eigenschaften der Seifenlösungen, in erster Linie mit ihrer Hydrolysier- und Emulgierungsfähigkeit zu vergleichen, und möchten uns dieses Arbeitsgebiet für einige Zeit vorbehalten.

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**Figure 1**
**First mention of carbon black, an artificial soil, which has been used extensively since and given rise to many strange results**

Launder-Ometer. The soil removals, expressed as ranged from 3% to 30%. Cotton and viscose rayon were much more difficult to clean than the other materials except for Dacron, where no soil could be removed at all.

*Vaughn* (11) in 1950 proposed a soiling mixture different from the one he had used previously, consisting simply of an aqueous suspension of carbonaceous matter.

*Draves & Skerburne* (24) developed a printed test cloth for which the printing paste contained 2% of a carbon black, 37% mineral oils and fats, further ethyl cellulose, sodium alginate and oleic acid/amine soap.

*Sanders & Lambert* (25) developed a synthetic soil composition containing 35% humus, 35% (in total) of different silicates, 1.5% carbon black, 2.5% iron oxide and approximately 10% of fatty acids and other oily material. This soil is added dry but is slightly wetted in the course of the application.

*Bernstein & Sosson* (26) used nine different soiled swatches, seven of which were based on some kind of carbon, one was a synthetic street dust (probably that of *Sanders & Lambert*), and one a vacuum-cleaner dust.

While *Sanders & Lambert* from their analysis of natural dusts (see below) derived the synthetic dust mentioned, *Goette et al* (27, 28) used natural vacuum-cleaner dust, but added 1% of carbon black. They also used iron-oxide soil in some experiments.

*Ringeissen* (29) reported the use of soil from dry-cleaning factories.

THE COMPOSITION OF NATURAL SOIL——*Brown* (30) has extracted the oily constituents of a number of garments after from one to eight uses, and found quantities ranging from 0.25% in shirts (average of eight uses) to 1.2% in soft cotton collars. This means that the amount of fatty matter (and probably of dirt as a whole) is much higher on the collars than on the remainder of the shirts which, of course, is by no means amazing.

**TABLE I**

| % | Results of analysis: Six samples of natural dust | Synthetic soil |
|---|---|---|
| Water-soluble | 11.4-15.9 | 9.8 |
| Ether-soluble | 4.9-12.8 | 5.1 |
| Moisture | 0.0- 3.8 | 8.0 |
| Total carbon | 24.0-28.9 | 25.8 |
| Ash | 50.5-57.8 | 40.9 |
| $SiO_2$ (total) | 21.4-26.4 | 21.9 |
| $R_2O_3$ " | 9.4-11.6 | 7.5 |
| CaO " | 6.2- 8.4 | 4.8 |
| MgO " | 1.6- 2.0 | 1.9 |
| CaO (water-sol) | 0.3- 0.7 | 0.3 |
| MgO " | 0.1- 0.2 | 0.2 |
| N | 0.0- 2.1 | 1.3 |
| pH (10% slurry) | 6.7- 7.3 | 8.9 |
| Carbon black equivalent (%) | 0.5- 0.8 | 1.2 |

The average composition of the oily components of "human dirt", which is somewhat different from that on tea towels, is about

30% free fatty acids, mean molweight 270
25% neutral fat
3% low-chain fats and fatty acids
42% nonsaponifiable, consisting of
25-65% alcohols, cholesterol, etc,
35-75% probably hydrocarbons.

On collars there is less free fatty acids, and correspondingly more neutral fat, than average. On tea towels is found more neutral fat (60%) and less nonsaponifiable (6%).

The free and combined fatty acids are mainly $C_{18}$ saturated and unsaturated acids with mean iodine values of 46.

*Sanders & Lambert* (25) analyzed the dust gathered in air-conditioning equipment in six American towns. An extract of their result is shown in Table I. Goette (26) analyzed vacuum-cleaner dust from an office in Germany and found values very similar to those of *Sanders & Lambert*.

*Sanders & Lambert* found that the color of natural soils corresponded to between 0.5 and 0.8 % of a rather coarse carbon black milled in a zinc oxide/oil paste. If natural dust contains some humus and iron oxide, as does their synthetic soil mentioned above, it will be dark only by virtue of these ingredients and *the carbon black content of natural dust should, in the present author's opinion, be almost negligible*. In spite of this, to their synthetic soil they added 1.5% of carbon black, resulting in a color darker than any of the natural soils tested, but, on the other hand, corresponding only to 1.2% carbon according to their indirect estimation method.

## MEASUREMENT OF SOIL REMOVAL

Four methods have been proposed for this purpose:

a) Determination of the quantity of soil on the cloth before and after the washing.
b) Determination of the amount of soil in the wash liquor.
c) Measurement of the turbidity of the wash liquor.
d) Reflectance measurements.

Since there is no good method for the analytical determination of carbon, the first two methods are not easily feasible. As mentioned above, *Utermohlen* has used iron-oxide pigment in place of the carbon black and has got interesting results by analysis of iron contents. The turbidity method will often give erroneous results, as pointed out by *Barker & Kern* (31). The reflectance method is, of course, a measure of the soil removal only to limited degree. On the other hand, it is more in line with practice where it is the improvement of visual cleanness that matters.

## RELATION BETWEEN SOIL CONCENTRATION AND REFLECTANCE VALUE

A considerable number of the papers referred to treat the question of the relation between soil concentration and reflectance value in detail.

*Rhodes & Brainard* (7) derived the equation

$$S = -229 \log B \qquad \text{(Eq 1)}$$

where B is the brightness ($= R/R_o$), and S is the amount of soil measured in suitable units (in our terminology kS). Including the constant 229 in k, the equation becomes

$$kS = -\log \frac{R}{R_o} \cdot \qquad \text{(Eq 2)}$$

For the soiling process, the authors give the equation

$$S = k_1 \cdot c^{\frac{1}{y}} \qquad \text{(Eq 3)}$$

where c is the concentration of soil in the liquid and S the amount of soil taken up by an absorbing surface in equilibrium with the liquid. Combining Equations 2 and 3 gives

$$-\log \frac{R}{R_o} = k_2 c^{\frac{1}{y}} \cdot \qquad \text{(Eq 4)}$$

In the early nineteen thirties, *Gurevic* (32), *Ryde* (33) and *Kubelka & Munk* (34) treated reflectance problems. The latter developed equations for the reflectance of a lacquered area of a given thickness on a given background. Their formula was transformed for use with paper pulp by *Steele* (35) and *Nolan* (36). F D Snell then used Nolan's formula in the following form

$$kS = \frac{(1 - R)^2}{2R} - \frac{(1 - R_o)^2}{2R_o} \cdot \qquad \text{(Eq 5)}$$

This equation, since, has been referred to as the "Kubelka-Munk equation".

It has been demonstrated, as will be mentioned below, that this equation is not valid for the relation between reflectance of and amount of soil on, soiled fabrics. In our opinion, this is because the assumption made by Nolan that the scattering coefficient of the dye is much smaller than that of the paper pulp, while probably being valid in the case of papers dyed with small amounts of dyes (say .05 to 0.1%), is not warranted when the question is of soiled textiles.

*Bacon & Smith* (13) showed that by plotting R against values for log S, calculated from R by means of the K-M equation, a straight line is obtained within certain limits. That means

$$R \approx k_1 - k_2 \log S \qquad \text{(Eq 6)}$$

supposing the K-M equation to be valid. Equation 6 is contradictory to Equation 2 above, which can be written

$$S = k_3 - k_4 \log R \cdot \qquad \text{(Eq 2a)}$$

*Utermohlen et al* (17, 18) used a black iron oxide pigment instead of carbon black, enabling them to fol-

low the uptake and removal of the soil by analysis of iron content, which is much easier to carry out than a determination of carbonaceous soils.

Although there are not unimportant experimental errors in the reported figures, and the influence on reflectance of the simultaneous removal of the fatty components of the soiling mixture is neglected, which leads the authors to conclusions which cannot be upheld following a critical evaluation of their results, it is clearly possible to deduct from their experiments that the K-M equation is not valid.

*Harris et al* (*16*) developed the following method for the estimation of the amount of graphite on fabric: boiling the fabric for 18 hours with concentrated nitric acid and a little sulfuric acid in order to dissolve the cotton, after which the graphite is dispersed in a solution of a little methyl cellulose in water and the passage of light measured. According to this paper, the K-M relation is reliable down to 28% reflectance only.

*Vaughn & Suter* (*11*) and *Snell, Snell & Reich* (*37*) also give values for reflectance and residual soil contents.

*Schoenberg* (*38*) reported further values. He introduced the reflectance $R_{\infty}$ of fabric soiled with infinite amounts of the soil in question. For an ideal black, $R_{\infty}$ is zero, but for ordinary carbon blacks a slight correction is obtained. He showed that the equation

$$kS = \frac{q}{(1-q)^2} \qquad \text{(Eq 7)}$$

where

$$q = \frac{R_o - R}{R_o - R_{\infty}} \qquad \text{(Eq 8)}$$

fits well into his own experimental values as well as into those of the authors cited above. Substituting Equation 8, Equation 7 is transformed into

$$k_1 S = \frac{R_o - R}{(R - R_{\infty})^2} \cdot \qquad \text{(Eq 7a)}$$

Occasionally, $S^n$ might be substituted for S.

## THE WASHING PROCESS

*Rhodes & Brainard* (*7*), for multiple washing series, found the cleanness of their test pieces increasing with the number of washes. On the other hand, they found that single washes of a duration of 15 minutes yielded better results than both shorter *and longer* washes. Further, they found that increased temperature, ie, 20, 40 and 80°C, improves the washing result only to a very limited degree. A number of different soaps tested showed but small differences.

These authors proposed the following equation for the washing process:

$$\log\left(\log \frac{B_i}{B_{i-1}}\right) = y \cdot \log 229 + y \log\left(-\log B_i\right) \qquad \text{(Eq 9)}$$

where $B_i \left(= \frac{R_i}{R_o}\right)$ is the "brightness" of the test pieces after the $i^{th}$ wash, and y is a constant obtained from Equation 3. Thus, the equation would mean that the washing result is independent of the time of washing, supposing that equilibrium is reached.

*Vaughn et al* (*9*) described a number of washing tests* and arrived at the following equation

$$S = S_o e^{-kt} \cdot \qquad \text{(Eq 10)}$$

*In an earlier paper (*8*), Vaughn et al treat properties, mainly pH, of "modified soda" (a mixture of 1.4 parts of sodium bicarbonate and one part sodium carbonate).

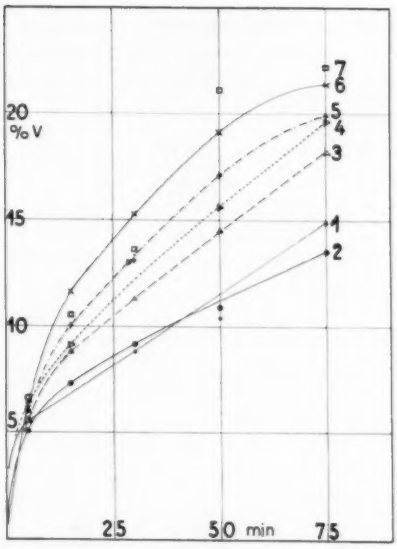


**Figure 2**

**0.1% soap, 0.05% builder**
1—No builder
2—$NaHCO_3$
3—Modified soda
4—$Na_3PO_4$, 12 $H_2O$
5—$Na_2CO_3$
6—Proprietary builder No. 3
7—NaOH (no curve drawn)
8—Proprietary builder No. 1 (Fig 4 only)

The authors measured soil removal partly by reflectance, partly by the turbidity of the wash liquor. However, as shown above, reflectance in itself is not identical with the amount of soil present, and turbidity is not a good measure of the soil content, at least in this case, when soap has been used as detergent. The authors themselves, in a later paper (*10*), expressed the washing results as visual cleanness $V = \frac{R - R_o}{R_o - R_o}$, and consequently have given up making any reference to their own earlier equation. Values from one of their tables are shown in Figure 2. The increases in reflectance range from as low as 7.2 to 11.7%, resulting in rather great deviations. At any rate the curves demonstrate the general course of the washing process quite well.

*Bacon & Smith* (*12*) have reported a number of Launder-Ometer tests. Making a number of assumptions which are not substantiated, eg, that the mechanical action should be doubled when the speed of rotation is increased by $\sqrt{2}$ (ie, from 42 to 59 rpm), they arrive at the equation

$$\Delta S = k_1 (dft)^n \quad (0<n<1) \cdot \qquad \text{(Eq 11)}$$

However their experimental values are too inaccurate to prove it. On the contrary, as Equation 11 can be transformed to

$$\log(\Delta S) = k_2 + n(\log d + \log f + \log t), \qquad \text{(Eq 12)}$$

plots of log ($\Delta$ S) against one of the variables, keeping the other two constant, should give parallel straight lines. The authors themselves have presented such diagrams showing straight lines which, however, are not parallel to each other.

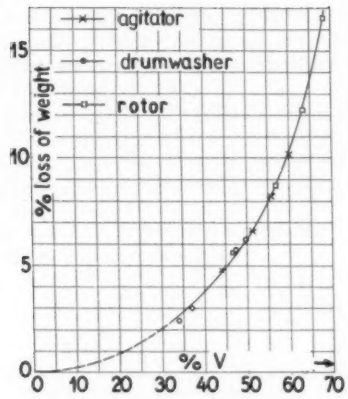


**Figure 3**
**Loss of weight of test swatches vs visual cleanness obtained in different washing machines under varied conditions**

In a later paper (*13*), using the K-M equation, they find that log ΔS is a linear function of R, and since, according to Equation 12 log ΔS is proportional to log t, it must follow that R is a linear function of log t, viz

$$R = k_3 + k_4 \log t \qquad \text{(Eq 13)}$$

if Equation 12 were valid.

*Pedersen* (*1*) has found values which are described by the equation

$$V = k_1 + k_2 \log t. \qquad \text{(Eq 14)}$$

However, since V has the general form $V = \frac{R - R_o}{R_\infty - R_o} = k_5 R - k_6$, this equation can be transformed into

$$R = k_5 + k_6 \log t. \qquad \text{(Eq 15)}$$

Using different types of washing machines, he found that $k_6$ is identical for all machines under similar conditions, while $k_5$ varies with mechanical efficiency. In a semilogarithmic diagram he thus gets parallel straight lines. The mechanical action exerted can be expressed by the time of washing necessary to obtain a certain degree of cleanness. For example a rotor machine with a 650 g load in four minutes produces the same washing result as the same machine without load (except 10 test swatches of 10 × 7 cm each) in 16 minutes, an agitator machine with normal load in 14, and a drumwasher with normal load in 30 minutes. He proves this assumption by weighing the amount of lints and fluffs removed from the load and plotting it against the visual cleanness obtained. This diagram is reprinted here as Figure 3.

The $k_6$ of Equation 15 varies, however, with the wash liquor insofar as it is greater for a solution of soda ash and soap than for plain water.

As *Schoenberg* (*39*) points out, at very short washing times the inclination of the curve for soap solution is lower, becoming similar to that for plain water. He finds that both curves are similar in shape and follow the general equation

$$S = \int_0 e^{\left(1 - \frac{1-s^4}{s^4}\right) at} ds = \text{approx } \frac{1}{\sqrt{1+b't}} \qquad \text{(Eq 16)}$$

where a (= 0.0184 b') varies with the machine tested and, also, with the medium (soap solution or plain water) and temperature used.

*Galbraith* (*23*) states that soil removal is increased with temperature up to either 120 or 140°F. In her experiments, however, the increase was in many cases even greater from 120 to 140°F than from 100 to 120°. Is there, then, any reason to believe that the influence of temperature should cease at 140°F (60°C)?

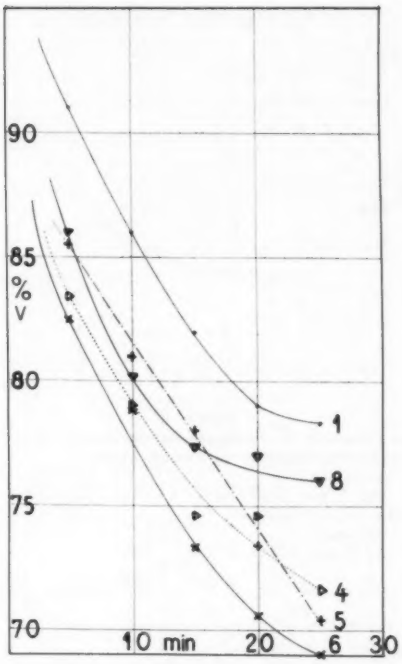


**Figure 4**
**Whiteness retention (See legend under Fig 2)**

It is well known that hard water precipitates soap, thereby increasing the soap consumption, if no softener is used. Synthetics are generally assumed to be essentially insensitive towards water hardness. In Galbraith's tests, however, a tremendous effect is found for all types of detergents, whether soap or syndet, built or not. In most cases the visual cleanness obtained in hard water is, even at 0.3% detergent concentration, lower than the corresponding value in distilled water at 0.1%, although the hardness of the water (250 ppm or 14° German) is by no means excessive.

Radioactive tracers have been used by *Ehrenkrantz* (*40*) and others. Radioactive atoms, however, are normally found in molecules the crystal shape, particle size, etc, of which are different from those found in natural soil. Hence, results of tests with isotopes should be regarded with caution.

## WHITENESS RETENTION

Soil suspension tests have been made since the works of *Spring* (*41*) and *McBain* (*42*).

*Vaughn et al* (*9*) made some tests to determine soil redeposition or whiteness retention for soap with various builders. Their results are given in Figure 4. They used a constant initial concentration of soil in their experiments and measured the decrease in reflectance of white test swatches.

Other workers have used a normal washing procedure of standard soiled or in other cases of naturally soiled cloth, adding white swatches and measuring the reduction in reflectance of these latter ones. But as other workers (*Bernstein & Sosson (26)*, for example) have pointed out, a low-efficiency detergent will give a high whiteness retention in this case only by virtue of the low amount of soil removed from the cloth.

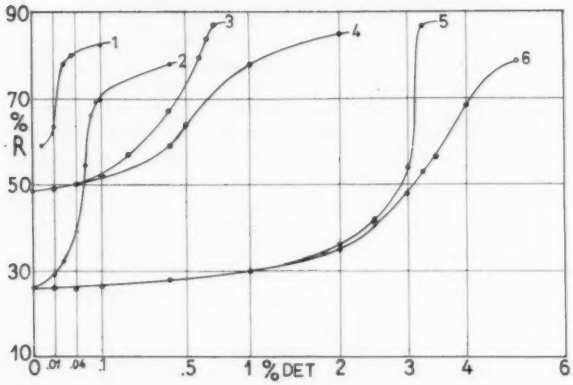


**Figure 5**
**Whiteness retention vs detergent concentration (Triton X-100) for different concentrations of carbon black**
Experimental values:
1—20 mg C per 100 ml
2—100 mg C per 100 ml
Calculated values:
3—20 mg C per 100 ml, K = 1000
4— do K = 1
5—100 mg C per 100 ml, K = 1000
6— do K = 1
Curves for K >>1000 are very similar to those for K = 1000

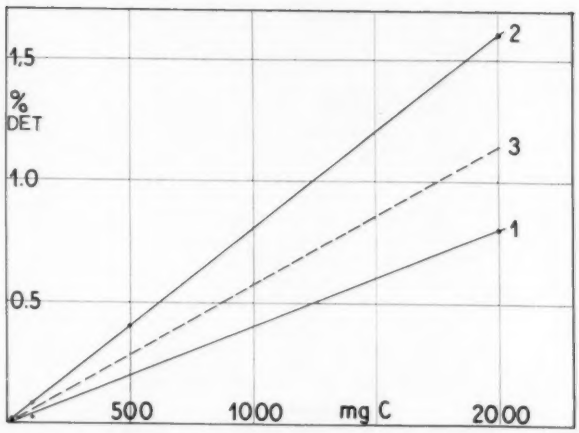


**Figure 6**
**Critical concentrations of detergent (Triton X-100) vs concentrations of carbon black**
1—Lower critical concentrations
2—Higher critical concentrations
3—(Mean) critical concentrations shown in the original paper

*Gruntfest & Young* (43) followed a method similar to that of *Vaughn*. They changed the concentration of carbon black and of the detergent and got curves such as Nos. 1 and 2 in Figure 5. (In Figure 5 a special quadratic scale is used as abscissa in order to allow all curves to be plotted in one diagram for easy comparison). It appears that there is a critical concentration of the detergent, or rather a critical range of detergent concentration (the steep part of curves 1 and 2). In the figures shown in the paper, with an equidistant abscissa, these ranges are more pronounced, yet the authors do not pay much attention to their existence and most often talk of the critical concentration in general. In Figure 6 are shown lower and higher critical concentrations depending on the amount of carbon black. Curve 3 is taken from one of the paper's figures showing " the critical concentrations", which obviously are mean values.

The authors suppose that the detergent process undergoes the following reaction scheme:
detergent (D) + soil (S) $\leftrightharpoons$ detergent-soil (D-S).
Assuming that the mass action law for chemical reactions is valid, then

$$\frac{D\text{-}S}{D \cdot S} = k \qquad \text{(Eq 17)}$$

If k, as well as original values of D and S, is known, the remaining amounts of soil can be calculated from Equation 17. The authors cited did this for a number of k's. Plotting the resulting curves, they found they had a shape similar to their experimental curves. However, they did not take the trouble to plot both types of curves in the same diagram, in order to show how good or bad the resemblance is. It is seen from Figure 5, where curves 3-6 are the calculated ones, that there is no possibility at all of relating these curves to each other.

*Galbraith* (23) used graphite-soiled swatches for washing tests, but for the estimation of whiteness retention preferred naturally soiled cloths, since the graying of nylon was more pronounced by this method. Seven-pound loads of sheets and pillowcases together with unsoiled test swatches of cotton, wool, viscose rayon, nylon, Orlon and Dacron were washed at 135°F in an automatic drumwasher. Whiteness retentions were good for cotton, rayon and Orlon (96%), lower for Dacron (94%), nylon (92%) and wool (81%). (Percentages cited are those for heavy duty syndet powders, heavy duty soap powders being slightly superior).

## PARTICLE SIZE

*Shuttleworth & Jones* (44), *Utermohlen* (17) and others have reported that the smaller the particle size of the soil, the more difficult is it to remove.

On the other hand, *Sanders & Lambert* (25) and *Goette* (27) have shown that the particle size of natural soil falls within a rather limited range.

*Vaeck et al* (20) using artificially soiled fabrics found more or less straight-lined curves for the washing process after the first or second wash. They infer that, during the first wash, the coarse fraction of the soil is removed completely, or nearly so, and then only the fine fraction is responsible for the further increase in reflectance. Extrapolating the straight-lined part of the curves back to zero they determined the distribution of the different soils in a fine and coarse fraction. On the whole, their other paper (21) has the same contents.

## CONCLUSIONS

It is evident that carbon soils are not representative of natural soil. Nevertheless some facts about the washing process are revealed by them, including the following:

a) The washing effect is dependent on the concentration of the detergent, at least up to a certain value. In the author's opinion, which has been backed by recent experiments, the influence of the detergent concentration, however, extends far beyond the optimum concentration found with carbon-black soils.

b) The type of detergent no doubt has important effects on the detergency, but the results obtained by many different workers with carbon soil seem not valid in practice.

c) The influence of the washing temperature has not

been given much attention, but a limited increase of detergency with increasing temperature is reported. (In this laboratory we have found considerably more effect from a rise in temperature).

d) The mechanical force applied during the washing process has considerable effect on the result. In machines exerting low mechanical action, the washing time has to be increased in order to get a reasonable washing result.

For the relation between reflectance values and amounts of soil, the expression

$$kS = \frac{q}{(1-q)^2}$$

is closer to experimental values than any other relation proposed. Quite a number of workers have occupied themselves with this question. In practice, the visual cleanness of the wash goods is of greater importance, independent of the amount of soil remaining on the clothes, unless it becomes objectionable from a hygienic point of view. Only few experiments have been reported using soils other than artificial mixtures containing carbon black. Of these, soil from drycleaning factories, in my opinion, is a material more like natural soil than any other yet proposed. Other soils, such as clarete, have been mentioned, and in this laboratory we have tried a number of different soils. Our experiments using tea and coffee have already been reported in a local publication (45).

Whiteness retention or soil redeposition, too, has been evaluated using carbon-soiled test strips, but in a number of cases naturally soiled cloth has been used. This is feasible, since the soil removed from the wash goods is measured after redeposition on *white* test swatches. The method has two drawbacks:

1) the type and amount of soil removed from the naturally soiled cloth might vary from bundle to bundle, but proper dividing of the batches for comparative tests can reduce this nuisance;

2) the amount of soil removed from similar bundles can vary with different detergents. With an inferior detergent, hence, only a low concentration of soil is obtained. This results in a low redeposition and, consequently, a too-high ranking of the detergent in question. The latter point should be negligible when recognized detergent formulations are used.

Thus it seems possible to use natural dirt in estimating whiteness retention.

*The role of bleach* has not been touched in this article although, in the writer's opinion, its importance is considerably greater than is normally assigned to it. Neither have optical whitening agents been covered.

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| | | | 1952 | 33 | 4 | 4 | 328 |
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# EFFECT OF YARN TWIST AND FABRIC COVER FACTOR ON CREASE RECOVERY AND TEAR STRENGTH

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It has been recognized that fiber properties and yarn and fabric geometry have an important influence on fabric properties such as crease recovery and tear and tensile strengths. In the treatment of fabrics with resins for improved crease recovery, especially for the drip-dry type of finishes, it is necessary to consider this for selection of the proper type of fabric for finishing. Experimental data on this subject have been available only recently for man-made fibers. The present paper gives results of the effect of yarn twist and fabric cover factor on crease recovery and tear strength of a poplin before and after treatment with a resin. The results point to some important considerations for selecting the optimum fabric constructions for such finishes.

## INTRODUCTION

LITTLE published information is available in literature of planned studies in which the effect of systematically altering one or more of the numerous variables of yarn and fabric construction on such properties as crease recovery and tear strength of the fabric after resin treatment has been investigated. General discussions, based largely on theoretical considerations, are available, however, dealing with the influence of structure and properties of fiber and of yarn and fabric geometry on resistance to and recovery from creasing deformations (*1, 2, 3, 4*). Lippert (*5*) has given an excellent summary of the effect of yarn and fabric construction on crease recovery. Briefly, the following factors are important for crease resistance and/or crease recovery:

1) Multifilament character of yarn is essential to minimize the strain on individual fibers when the textile is under a creasing stress. The finer the fiber, the better will be the stress distribution for a given count of yarn.
2) A minimum fiber length is necessary to ensure adequate fiber-to-fiber cohesion in the yarn without which fibers may be displaced permanently under a bending stress.
3) High elasticity of the fiber would give better crease recovery.
4) In cellulosic fibers, high crystalline orientation to fiber axis and small angles between the crystallites and the fiber axis lead to poor crease resistance and poor crease recovery.
5) The fiber should have sufficiently high extensibility so that it does not rupture under the strain and make recovery impossible.
6) Low twist, low count and high crimp in the yarn lead to better crease recovery.
7) Fabric constructions which are more open, have less yarn-to-yarn intersections for a given number of ends and picks, and which have a disoriented state of fibers and yarns, as in corduroy and napped material, will all promote crease recovery.

Some experimental data are also available on the changes in fabric properties due to resin treatment of a variety of commercial fabrics of different weaves and constructions. Nuessle (*6*) treated several fabrics of oxford, herringbone, twill, plain and sateen weaves with a wide range of yarn and fabric count and weight/square yard, with a melamine resin under identical conditions. He found that the oxfords gave the least tear strength loss for equivalent values of crease recovery. He also found that the magnitude of improvement in tear strength of the resin-treated fabric after treatment with a softener (of a durable water-repellent type) varied with the fabric type. Those fabrics which were initially stronger also had higher strength after resin treatment. In a similar study, Smith (*7*) treated twelve commercial fabrics of widely different constructions with urea and melamine resins. There were wide variations in the properties of the treated fabrics and two of the fabrics showed much lower losses of tear and tensile strength for equivalent crease recovery. He concludes that "there would appear to be sufficient evidence to suggest that suitable choice of fabric construction has a profound effect on the strength of the crease-resisted material."

Recently this subject has been receiving attention particularly in the man-made fiber industry. Krasny and coworkers (*8*) studied the effect of construction on the crease recovery of Fortisan fabrics without any resin treatment. They concluded that, in a filament fabric of given weight, constructed from filaments of a given denier, the following measures should improve crease recovery:

1) Reduction of fabric tightness by use of a) lowest number of yarns per inch and highest denier consistent with the use of the fabric and b) a weave with larger longer floats and shorter floats of at least 2.
2) Use of twist reversal in ply twisting, eg, Z ply S single twist for improvement of crease recovery in system normal to the twisted one. Thus improvement in warp crease recovery can be obtained by reversed ply twist in filling.

Sookne et al (*9*) have discussed the effects of fabric structure (weave and tightness) on the "wash-and-wear" rating, crease recovery, tear strength and tensile strength of viscose lining fabrics treated with dimethylolethylene urea at two levels of add-on. They conclude that the first three properties improve as the fabric becomes more open or the weave contains longer floats.

Hilton, Lund and Martin (*10*) have recently reported the effect of yarn twist, yarn count, fiber fineness and

fabric cover factor on the crease recovery of viscose fabrics.

Similar data on cotton fabrics do not seem to be available in literature. The work reported here was completed four years ago as part of a larger project sponsored by a group of mills. Since the interest of the sponsors was confined to poplins constructed from cotton yarns of 38's to 40's count, the only variables of construction studied were yarn twist and fabric tightness (or cover factor).

## EXPERIMENTAL PROCEDURE

EFFECT OF YARN TWIST———38's count yarn was spun at three levels of twist, 24.48, 21.08 and 18.06 turns per inch. This is the normal range of twists used for this yarn in the industry. The first and second were used as warp and the second and third as filling to construct seven different fabrics at two levels of fabric cover factor. Details of fabric construction are shown in Table I. These fabrics, in one lot, were desized, scoured, bleached and mercerized in a mill under the usual conditions. They were then treated, again in one lot, with a resin bath containing a 1:2 mixture of a commercial methylol urea and methylolmelamine, and magnesium chloride (hexahydrate) catalyst, 30% on the weight of the resin. Resin concentrations in the bath were adjusted to give 4, 6 and 8% resin solids add-ons on the fabric. After padding, the samples were dried on pinframes at original dimensions at 110°C for eight minutes, cured at 150°C for five minutes, washed thoroughly with soap and soda ash, dried and finally conditioned for 24 hours at 65% RH and 80°F. The conditioned samples were tested for crease recovery (Monsanto; ASTM D 1295-53T) and tear strength (Elmendorf; ASTM D 1424-56T).

EFFECT OF FABRIC COVER FACTOR*———Eight fabrics with different ends and picks per inch were woven from the same warp (38's, 24.48 tpi) and filling (38's, 18.06 tpi). Processing, resin treatment and testing were carried out in the same manner as described earlier. Three commercial poplins, two of which used doubled yarns as warp and filling, were also included in the study. Table II gives details of construction of the eleven fabrics used in this study.

## RESULTS AND DISCUSSION

Table III gives the results of crease recovery and tear strength of the fabrics described in Table I. The relation between crease recovery and tear strength for these seven fabrics at various levels of resin add-ons is shown in Figure 1. Within a set, that is, for fabrics having the same fabric cover factor, crease recovery of the fabrics at equal resin add-ons is not very different. For most of the fabrics in the untreated state, fillingwise crease recovery is higher than warpwise, but this difference disappears after resin treatment. Figure 1 shows that the crease recovery-tear strength relation is the same for fabrics with the same fabric cover factor. In other words, irrespective of changes in warp or filling twist within the range studied here, the loss in tear strength at equivalent crease recovery is the same for fabrics with the same fabric cover factor. On the other hand, between the two sets of fabrics, with different cover factors, there is a wide difference. The fabrics with the lower fabric cover factor start initially with a much higher tear strength and though the rate of tear strength loss with increasing crease recovery is higher with these fabrics than with those having the higher cover factor, the former continue to maintain higher tear strengths at all levels of crease recovery. These results corroborate Nuessle's observa-

**TABLE I**
**Details of yarn twist and fabric construction**

| Set no. | Fabric no. | Turns per inch: Warp | Turns per inch: Filling | Ends/Picks per inch after bleaching | Fabric cover factor |
|---|---|---|---|---|---|
| | 7 | 24.48 | 18.06 | 128/70 | 23.7 |
| | 10 | 24.48 | 21.08 | " | " |
| I | 14 | 21.08 | 21.08 | " | " |
| | 16 | 21.08 | 18.06 | " | " |
| | 3 | 24.48 | 18.06 | 93/59 | 19.5 |
| II | 24 | 21.08 | 18.06 | " | " |
| | 26 | 21.08 | 21.08 | " | " |

**TABLE II**
**Details of yarn twist and fabric construction**

| Fabric no. | Ends/Picks per inch after bleaching | Fabric cover factor |
|---|---|---|
| 3 | 93/59 | 19.50 |
| 19 | 109/53 | 20.85 |
| 18 | 107/60 | 21.06 |
| 2 | 96/78 | 21.26 |
| 11 | 110/71 | 22.03 |
| 5 | 126/51 | 22.66 |
| 6 | 128/58 | 23.08 |
| 7 | 128/70 | 23.70 |
| J* | 132/64 | 23.65 |
| $S_1$* | 155/83 | 28.36 |
| $S_2$* | 128/65 | 28.64 |

| * | Count: Warp | Count: Filling | Turns per inch: Warp | Turns per inch: Filling |
|---|---|---|---|---|
| J | 39 | 39 | 19.2 | 15.30 |
| $S_1$ | 2/116 | 2/118 | 12.8 (Doubling twist) | 12.90 (Doubling twist) |
| $S_2$ | 2/76 | 2/76 | 8.8 (Doubling twist) | 8.5 (Doubling twist) |

**TABLE III**
**Effect of yarn twist and fabric cover factor on fabric properties**

| Fabric no. | Treatment | Crease recovery: W | Crease recovery: F | Crease recovery: T | Tear strength (g): W | Tear strength (g): F | Tear strength (g): T |
|---|---|---|---|---|---|---|---|
| 7 | Untreated | 68 | 69 | 137 | 1122 | 700 | 1822 |
| | 4% | 126 | 122 | 248 | 616 | 304 | 920 |
| | 6% | 138 | 134 | 272 | 624 | 256 | 880 |
| | 8% | 145 | 142 | 287 | 653 | 200 | 853 |
| 10 | Untreated | 69 | 76 | 145 | 1106 | 816 | 1922 |
| | 4% | 125 | 129 | 254 | 797 | 424 | 1221 |
| | 6% | 133 | 131 | 264 | 653 | 296 | 949 |
| | 8% | 149 | 147 | 296 | 573 | 237 | 810 |
| 14 | Untreated | 69 | 73 | 142 | 1085 | 829 | 1914 |
| | 4% | 130 | 138 | 268 | 709 | 400 | 1109 |
| | 6% | 138 | 141 | 279 | 637 | 288 | 925 |
| | 8% | 143 | 145 | 288 | 520 | 261 | 781 |
| 16 | Untreated | 68 | 76 | 144 | 1117 | 807 | 1924 |
| | 4% | 137 | 127 | 264 | 757 | 408 | 1165 |
| | 6% | 140 | 135 | 275 | 688 | 277 | 965 |
| | 8% | 145 | 144 | 289 | 608 | 224 | 832 |
| 3 | Untreated | 80 | 86 | 166 | 1754 | 1293 | 3047 |
| | 4% | 132 | 136 | 268 | 1360 | 352 | 1712 |
| | 6% | 139 | 144 | 283 | 1029 | 288 | 1317 |
| | 8% | 148 | 151 | 299 | 832 | 208 | 1040 |
| 24 | Untreated | 68 | 84 | 152 | 1715 | 1375 | 3090 |
| | 4% | 134 | 138 | 272 | 984 | 352 | 1336 |
| | 6% | 137 | 138 | 275 | 981 | 344 | 1325 |
| | 8% | 151 | 143 | 294 | 776 | 261 | 1037 |
| 26 | Untreated | 72 | 89 | 161 | 1513 | 1418 | 2931 |
| | 4% | 124 | 132 | 256 | 1159 | 349 | 1508 |
| | 6% | 142 | 139 | 281 | 901 | 304 | 1205 |
| | 8% | 151 | 151 | 302 | 829 | 245 | 1074 |

*Fabric cover factor has been defined as (*11*)

$$\frac{n_1}{\sqrt{c_1}} + \frac{n_2}{\sqrt{c_2}} - \frac{n_1 n_2}{28\sqrt{c_1 c_2}} \quad \text{for single yarn fabric}$$

and $$\frac{2n_1}{\sqrt{c_1}} + \frac{2n_2}{\sqrt{c_2}} - \frac{4n_1 n_2}{28\sqrt{c_1 c_2}} \quad \text{for doubled yarn fabric}$$

where, $n_1$ and $n_2$ are ends and picks per inch
and $c_1$ and $c_2$ are warp and filling counts for single yarn.

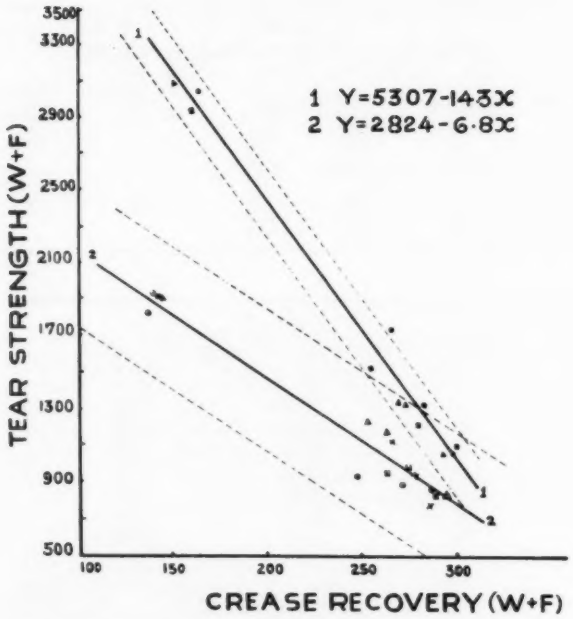


Figure 1

Effect of yarn twist on crease recovery-tear strength relation of fabrics. Fabrics 7 (o), 10 (Δ), 14 (x), 16 (□); 3 (●); 24 (▲), and 26 (■).

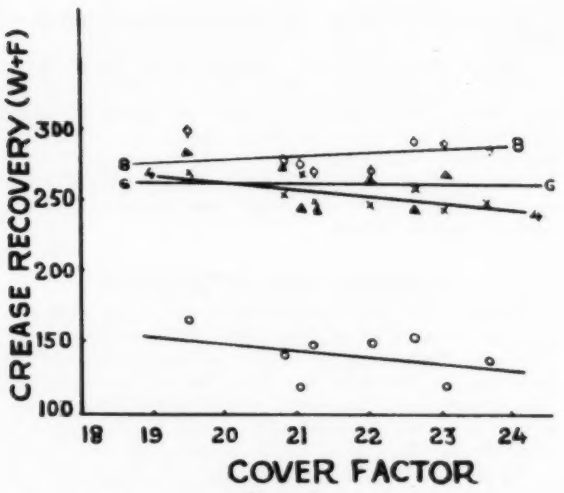


Figure 2

Effect of fabric cover factor on crease recovery. Untreated (o), 4% resin add-on (x), 6% (Δ), and 8% (ø).

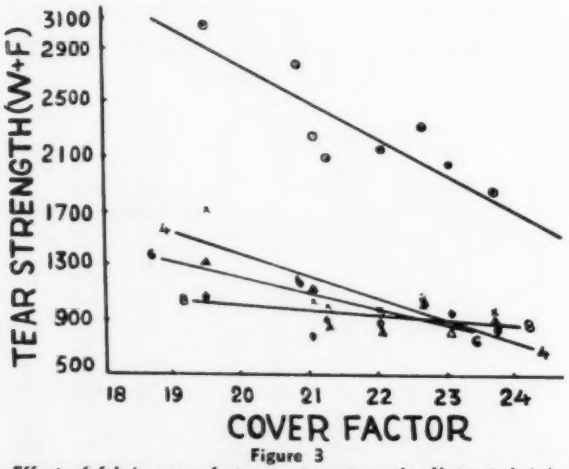


Figure 3

Effect of fabric cover factor on tear strength. Untreated (o), 4% resin add-on (x), 6% (Δ), and 8% (ø).

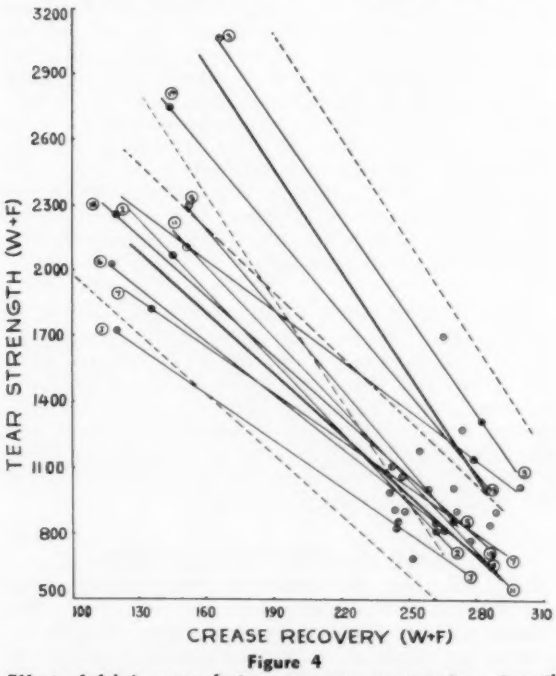


Figure 4

Effect of fabric cover factor on crease recovery-tear strength relation (single-yarn fabrics).

tion that fabrics which are stronger initially are also stronger after resin application.

The influence of cover factor on fabric properties can be seen in greater detail from the results obtained with the fabrics described in Table II. The relations between cover factor, and crease recovery and tear strength respectively are shown in Figures 2 and 3 for the eight experimental fabrics at 0, 4, 6 and 8% resin add-ons. Though detailed data for these fabrics are not given here, it was observed again that, for most of the untreated fabrics, fillingwise crease recovery was higher than warpwise, the difference being eliminated almost completely after resin treatment. Tear strength of the untreated fabrics made from the same yarn decreases sharply as fabric cover factor increases, whereas crease recovery shows a moderate decrease. The latter result is in agreement with the data given by Hilton et al (*10*). With increasing amounts of resin solids applied, the slope of the line in both Figures 2 and 3 decreases, indicating that the initial differences, due to fabric cover factor, in crease recovery and tear strength are gradually reduced with increasing resin solids on the fabric. It is of interest to note, however, that at 4% resin add-on, which has given values of crease recovery such as are generally required in industry, the influence of fabric cover factor, particularly on tear strength, is definitely significant. Another way of looking at the results is to see the crease recovery-tear strength relation of the various fabrics at different levels of treatment. This is shown in Figure 4.

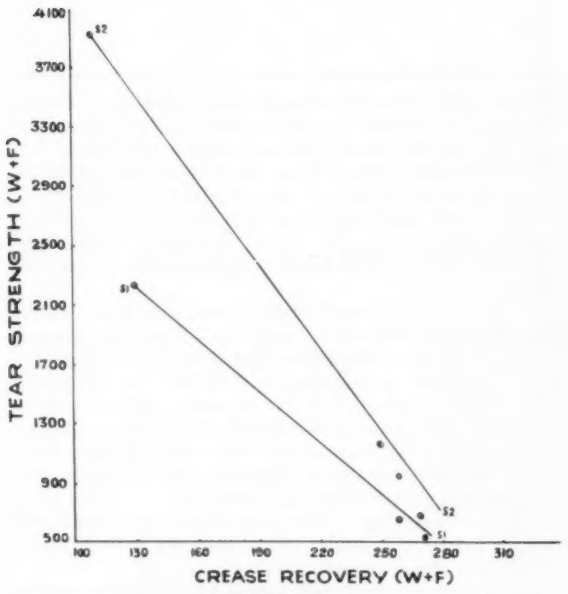


**Figure 5**
**Effect of fabric cover factor on crease recovery-tear strength relation (doubled-yarn fabrics).**

A statistical analysis of these relations divides the eight fabrics into two groups, Fabrics 3 and 19 in one and the remaining six in another. For the first group, with the lowest cover factors, tear strength is initially much higher than for the second group, and continues to be significantly higher at all levels of crease recovery, in spite of a steeper fall in tear strength with increasing crease recovery.

Of the three commercial fabrics, Fabric J was made of 39s warp and 39s filling and had approximately the same construction and cover factor as experimental Fabric 6. The only difference was that both warp and filling had softer twists in the former fabric. The crease recovery-tear strength relation of these two fabrics is practically identical except that, for the commercial fabric, it is displaced slightly towards lower values of tear strength, probably because of a more severe processing before resin treatment. This result substantiates the earlier conclusion that, within the range normally used, twist has no significant effect on the crease recovery-tear strength relation of resin-treated fabrics.

The other two commercial fabrics made from doubled yarns show an interesting difference (Figure 5). These two fabrics, $S_1$ and $S_2$, have approximately the same cover factor, obtained respectively by using a finer yarn and higher thread density, and a coarse yarn and lower thread density. In the latter case, doubling twist is also softer. (Unfortunately data on single twist could not be obtained). Of these two fabrics, $S_2$ gives a decidedly more favorable crease recovery-tear strength relation. Furthermore, $S_2$, with a much higher cover factor, has given a crease recovery-tear strength relation similar to Fabrics 3 and 19 made from single yarns of the same count but having a lower cover factor.

## SUMMARY

The following conclusions can be drawn from this study:

Twist variations in the yarn, within the range normally used in industry, do not produce a significant effect on crease recovery and tear strength of resin-treated fabrics.

Fabric cover factor, which for the same weave is an index of the number of threads per square inch, has a marked effect on both these properties. Both tear strength and crease recovery decrease with increasing cover factor, the former to a much larger extent. This effect is reduced considerably with increasing amounts of resin add-on, with the result that the crease recovery-tear strength relation was found to be significantly better only for the two fabrics with the lowest cover factors. At 4% resin add-on (crease recovery = 250), which probably represents conditions of the bulk of commercial processing, cover factor has still a large effect on tear strength.

From the limited data on doubled-yarn fabrics, it appears that, for the same cover factor, a fabric with coarser yarn and fewer threads per square inch is to be preferred to one with finer yarn and more threads per square inch. Such a construction from doubled yarns makes it possible to use fabrics with a high cover factor and yet achieves the same desirable crease recovery tear strength relation as obtained with single yarn fabrics of low cover factor.

## ACKNOWLEDGMENTS

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Tear sheets of articles which have appeared in AMERICAN DYESTUFF REPORTER since July, 1956 are available in limited quantities. (Consult yearly indexes for list of titles). These may be obtained by sending a stamped, self-addressed envelope along with a request for the specific articles. Write TEAR SHEETS, American Dyestuff Reporter, 44 East 23rd St, New York 10, NY.

# ADR ABSTRACTS

## High-temperature Dry-dye Fixation

Audas, F G, *125*, 901-2, 905, 907, 937-40, June 16 and 30, 1961

This paper deals with the dyeing of fabrics of hydrophobic character by a method involving the three process steps of padding, drying and finally fixation of the dried dyestuff at high temperatures.

Experimental work showed that good fixation of disperse acetate dyes could be achieved on fabrics consisting of Terylene, nylon and acetate rayon by a process of padding followed by a single heat treatment in a fluid bed, where drying followed by dye fixation both took place.

It has been found that in comparison with conventional processes the fixation or utilization of dyestuffs when using this new method is often "favorably high", and in some cases depths of shades may be obtained on difficult fabrics which are impossible or uneconomical by processes employing conventional aqueous dyebaths.

By using temperatures of *ca* 200°C, the fixation of dyestuffs is usually accomplished in times between 10-60 seconds, depending somewhat on the weight and type of the fabric and the type of dyestuff which is applied.

This work has been carried out with the exclusive use of a fluid bed as the heating medium, but any general conclusions reached should apply equally to allied methods (eg, the Thermosol method of Du Pont).

For the fixation of the disperse dye, the temperature of the fluid bed should be between 175° and 225°C. Above 225° there is a risk of damage to Terylene and nylon fabrics.

The pad-bath contains, besides the disperse dye, 5% glycerin (or other assistant, eg, diacetine or triethenolamine), a wetting agent (eg, Perminal PP), and sodium alginate as thickener if necessary. The fabric is padded, well mangled, and run through the fluid bed at 195°C (225°C for triacetate). For the spun and continuous filament materials the heating times recommended are respectively 20 and 10 seconds.

After heating, the cloth is vibrated to detach bed particles, washed, and re-dried in a second fluid bed at 150°C.

Attempts to apply premetallized, basic and azoic dyes to the hydrophobic synthetic fibers by a similar process are also described.

Five references to the literature are cited.

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## Defending the Frontiers of Civilization

David, J, *Dyer* 125, 803-4, June 2, 1961

In this paper the author discusses methods of protecting textiles against fungal and bacterial attack.

He first reviews the historic development of our knowledge of microorganisms and their relationship to disease in plants and animals. He mentions the work of Pasteur on antibodies and of Lister on antisepsis, and refers to the potato blight in Ireland in 1845 and later failures in other major crops.

The early work had shown that copper and phenol could kill microorganisms, and since that time research has produced many compounds based on these principles.

Rotproofing treatments for textiles may be divided into four classes: a) inorganic (eg, copper oxide), b) metal-organic complexes (eg, copper naphthenate), c) organic (eg, pentachlorphenol), d) modification of the fiber (eg, by acetylation).

Regarding inorganic treatments, the author mentions the use of Schweitzer's reagent (an ammoniacal solution of copper hydroxide) for the treatment of cotton canvas, and the deposition of "mineral khaki" (oxides of iron and chromium) on cellulosic fibers. In this group the copper derivatives are of the greatest importance.

One of the best fungicides and bactericides known is copper naphthenate. In the U S, copper 8-hydroxyquinolinolate has also found wide use as a rotproofing agent.

In the group of purely organic compounds, the chlorphenols are well-known fungicides. They are open to objection for durable application to textiles because of poor resistance to leaching, and in the case of pentachlorphenol, because of its corrosive action and its irritation of the mucous membrane of the nose and eyes. Pentachlorphenol laurate, however, which is noncorrosive, is an effective insect repellent, and is used also in drycleaning solvents for mothproofing.

Other rotproofing treatments which are mentioned include chemical modification of the cellulosic fiber by acetylation and cyanoethylation.

The author in conclusion warns that resistant microbial stains are capable of development, which will actually grow on copper sulfate, paranitrophenol, and other bactericides.

•

## Wash and Wear

Anon, *Dyer* 125, 761-2, May 19, 1961

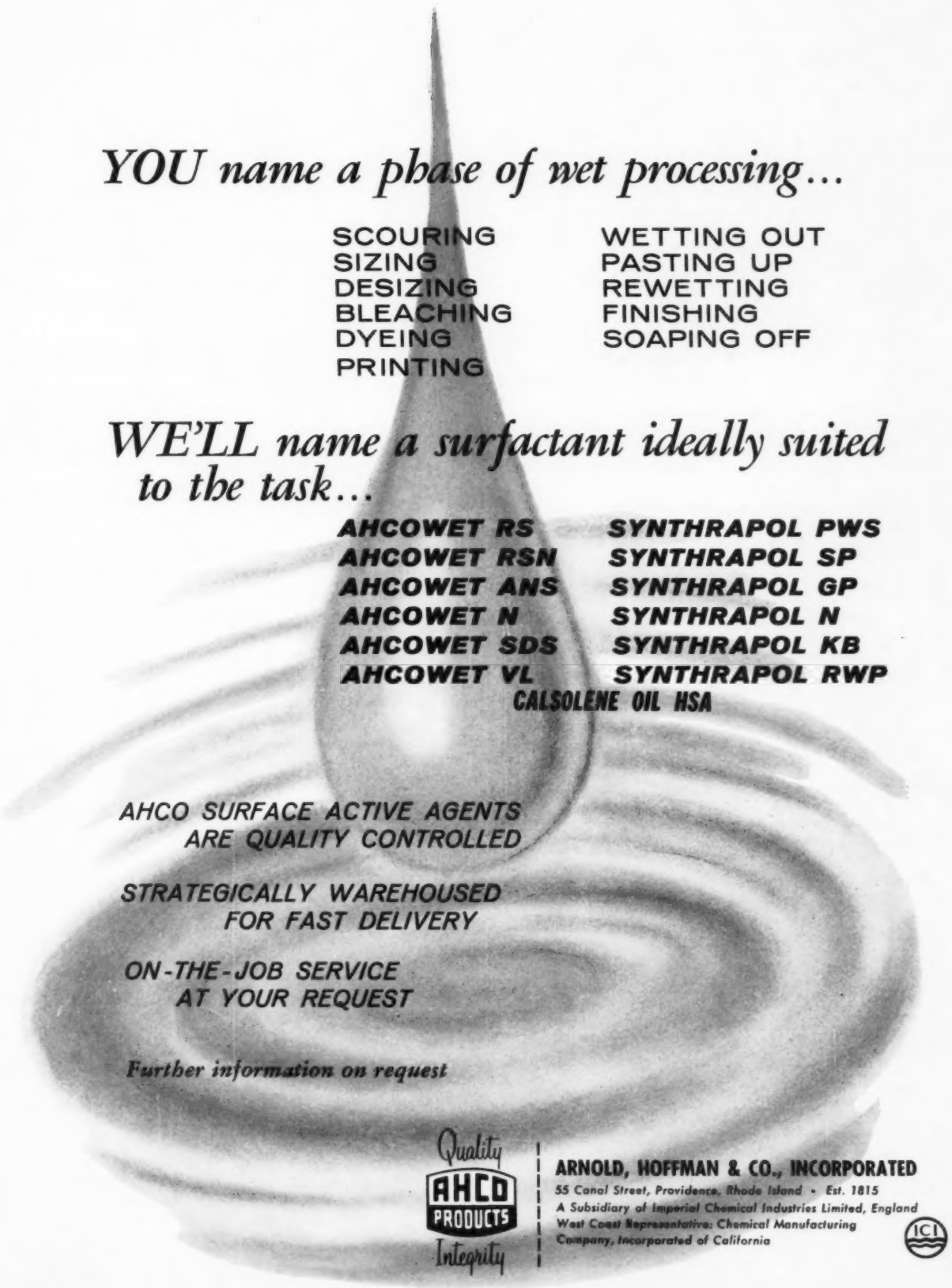
The following comments on the present status of "wash-and-wear," taken from a British journal, are rather interesting.

"Wash-and-wear", the author says, "has never met the entire claims of some of its promoters, but it has taken some of the drudgery out of domestic washing. Expressed in terms of everyday life, what has been achieved is the availability of fabrics which under selected laundering conditions do not shrink—which do not require full ironing but only a very light treatment—which after a light ironing treatment and during wear are free of undesirable wrinkles—which retain the prescribed creases or pleats—and which meet the requirements of a specified end-use."

Regarding the selection of suitable materials for "wash-and-wear" garments, the author summarizes the experience of the garment manufacturers. Fabric construction was found to be particularly important, he says, and appreciable differences in performance were found amongst similar fiber contents and weights but different structures. In the case of viscose rayon staple fabrics it was found that the coarser, shorter fibers with the lower twist factors were helpful.

Further, it was established that the open-weave structures, such as basket weaves, were to be preferred to the closer structures. The heavier fabrics had a better performance than the lighter weight. In the case of viscose filament lining fabrics it was found that the number of yarn crossings per square inch was a useful index of fabric openness, and that the more open fabrics exhibited improved crease recovery, wash-and-wear properties, and tear strength. A 3 × 1 twill was found to give a better result than the more normally used 2 × 1 twill.

It was also found, however, that in trying to choose the optimum construction, other practical considerations must be taken into account, as the most open fabrics tended to suffer from fraying during handling, and also to present sewing difficulties.



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## The Dyeing of Cellulose Acetate with Disperse Dyes.
## 10. Saturation Values with Mixtures of Dyes

Bird, C L and Rhyner, P, *J Soc Dyers & Col* 77, 12-16, Jan, 1961

In general, the behavior of secondary cellulose acetate towards disperse dyes is that of a solvent. At any given temperature the fiber is capable of dissolving a definite amount of dye. The maximum solubility, or fiber saturation value, varies from one dye to another, and increases with increasing temperature.

If more than one dye is present, the dyes usually dissolve in the fiber independently, ie, without interaction, but in some cases, with dyes of similar chemical constitution, interaction does occur, and the total solubility may be less than that of one of the individual components of the mixture. Several instances in the literature of such fiber interaction are described.

Saturation values are important in practice, because some of the blue anthraquinone dyes have low saturation values and will not "build-up" to give deep dyeings. This difficulty can be overcome by using a mixture of dyes, if the saturation values are additive. Thus, a mixture of two similar anthraquinone blue dyes, which gives deeper dyeings than either dye used separately, has been patented by Ciba.

The authors describe their investigation of eight anthraquinone blue dyes, all very similar in chemical constitution and all having low fiber saturation values on cellulose acetate when used separately. These were combined, two or three dyes at a time, and were applied to cellulose acetate yarn at 85°C as fine aqueous dispersions with Ultravon W. The amount of dye on the fibers was determined later by colorimetric analysis.

The fiber saturation values of the dye mixtures (shown in tabular form) in most cases were slightly lower than the sum of the saturation values of the individual dyes in the mixtures (in a few cases, much lower, indicating dye interaction).

The authors agree that with disperse dyes which are insufficiently soluble in cellulose acetate fiber to yield a full shade, the difficulty can sometimes be overcome by using a carefully selected mixture of two or three dyes of similar hue and chemical constitution. They state, however, that there is no evidence that the solubility in cellulose acetate of a mixture of disperse dyes can exceed the sum of the solubilities of the individual components.

Seven references to the literature are cited.

•

## Dimensional Stability of Wool Fabrics

Cednaes, M, *J Textile Inst* 52, T251-71, June 1961

The object of this investigation was to discover how the dimensions and the dimensional stability of wool fabrics change with setting treatments, and how the dimensional stability is related to other mechanical properties of set cloths.

The usual processes for setting wool cloth are crabbing and blowing, in which the cloth is wound on cylinders and treated with water or steam at a high temperature. The effectiveness of these processes is influenced by the tension and moisture content of the cloth and the temperature and time of treatment.

Wool fabrics may shrink on being immersed in water or on being steamed, and three different types of shrinkage (in addition to felting shrinkage) can be distinguished:

1) A relaxation of strains introduced by previous finishing treatments. The relaxation takes place when the cloth is wetted or treated with wet steam.

2) A change in dimensions which takes place when the moisture content of a relaxed cloth is altered. This change is reversible, and is dependent on cloth construction and on the degree of heat-setting given to the cloth.

3) A change in dimensions due to steam pressing. This change can be a relaxation shrinkage, but there is also a specific "press shrinkage" indirectly dependent on the reversible shrinkage.

To summarize briefly, it is shown that shrinkage of lightly scoured wool cloth is caused mainly by the moisture content of the fiber, and is reversible; but a change of moisture content can cause shrinkage which may be more or less permanent. From the point of view of shrinkage, the cutting of the pattern is critical. It is important to know what conditions the cloth will meet afterwards in making-up into clothes and during wear by the consumer, and how the fabric behaves under these conditions.

During clothing manufacture, steam pressing is most important as regards shrinkage. If this is done manually, the presser may adjust the number of pressings and thereby control the amount of shrinkage, but in an automatic pressing process this is impossible, and the shrinkage tolerances decrease.

The author recommends a precise control of the various finishing processes, eg, in piece-dyeing. He points out that dyeing is a very hard setting treatment, and the properties of the cloth might be greatly influenced by the time of dyeing.

It is also pointed out that short treatments at high temperature in aqueous solutions of certain reducing agents (eg, sodium bisulfite) are effective setting agents.

Thirty-six references to the literature are cited.

•

## How to Resin-treat Wool Fabrics for Shrink Resistance

Anon, *Textile Inds* 125, 61, Jan, 1961

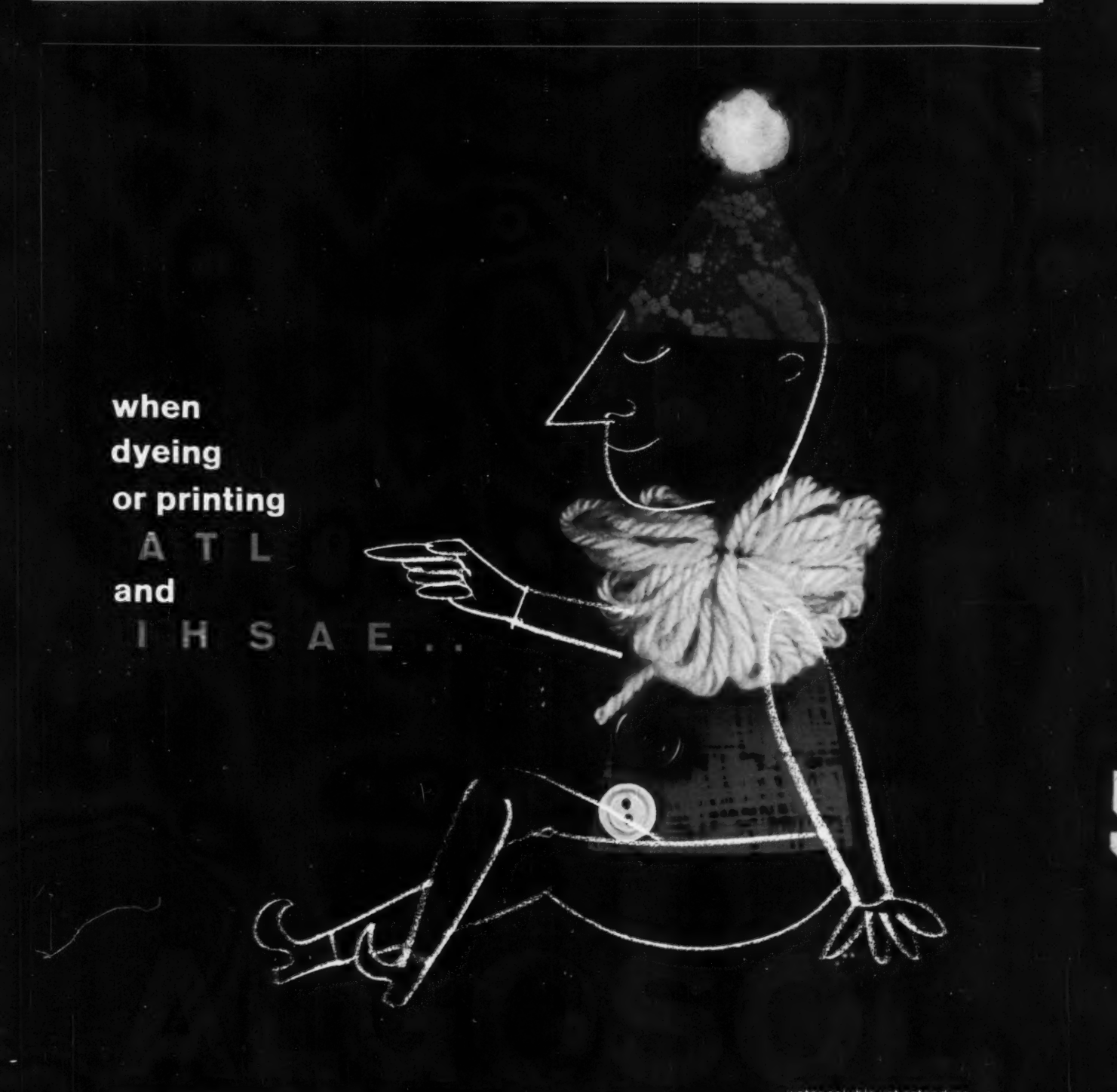
Directions for formulation and application of an epoxy-polyamide resin to wool fabric for resistance to shrinkage have been released by the Wool and Mohair Laboratory, U S Dept of Agriculture, Albany, Calif, developers of the process. The treatment makes wool fabrics launderable in home-type machines; it also imparts anti-muss, easy-ironing properties to the fabric, it is said.

A typical resin formulation contains 3% by weight of resin solids, with the epoxy resin comprising 60% of the total resin and the amino polyamide resin (eg, Versamid 125, General Mills) comprising 40%. Other components in the resin emulsion are a suitable emulsifier (eg, Igepal DM-710) and ethyl acetate. Full directions are given for making the emulsion. Several epoxy resins have been found satisfactory for this process (eg, Epon 828, Shell Chemical Co).

The wool fabric should first be thoroughly scoured and conditioned to at least a neutral or slightly alkaline pH. A nonionic surfactant (eg, Triton X-100) and tetrasodium pyrophosphate are recommended for this operation, conducted at 120°F.

The resin emusion is applied to the fabric on a conventional padder. The fabric is then dried and cured in a single step in a circulating-air oven at 275°F, and is washed to remove unfixed resin and soften the hand.

The author cautions that a number of epoxy resins are irritating to the skin, requiring the use of rubber gloves, and that ethyl acetate is highly flammable.

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September 4, 1961 No. 18

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# COMMITTEE ON WASH AND WEAR BROADENS ITS TEST PROCEDURES

GRAHAM M RICHARDSON
*Chairman, Committee RA61*

The following method is a revision* of AATCC Tentative Test Method 88-1960T. It incorporates all of the features of AATCC 88-1960T and the addition of a second evaluation procedure. These two evaluation procedures are termed *low-angle* and *overhead* procedures. The low-angle procedure is the same as existed in AATCC 88-1960T. A brief description of and justification for the overhead method follows.

The low-angle procedure has found wide acceptance in the trade. It has proved particularly useful where the evenness of the fabric surface is of major concern. In research studies and finishing plant control this is frequently the main objective. On the other hand, a less critical illumination procedure similar to that in which end-use garments are viewed is needed in order to serve a broader segment of the textile industry. This phase of the industry (mainly those interested in garment evaluation) is concerned only with appearance and, in cases where pattern prints or surface texture may contribute to improved "wash-and-wear" appearance, test conditions allowing for the integration of this effect were desired.

The Subcommittee on Lighting and Photographs has been investigating this matter and conducting interlaboratory tests for three years. The most recent interlaboratory tests clearly demonstrated that the objective discussed above is fulfilled by the overhead procedure.

C S CLUTZ, *chairman*
Subcommittee on Lighting & Photographs,
AATCC Committee on Wash and Wear

*Approved by letter ballot of the Technical Committee on Research in April, 1961.

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# APPEARANCE OF WASH AND WEAR FABRICS AFTER HOME LAUNDERING

## *Tentative Test Method 88-1961T*

(Adopted as Tentative 1958; revised 1960, 1961)

## PURPOSE AND SCOPE

THIS method is intended to evaluate only the retention of original smooth or surface textured appearance of "wash-and-wear" fabrics after repeated home launderings.

## PRINCIPLE

Fabric specimens are subjected to procedures simulating home laundering practices. A choice is provided of two alternative washing temperatures, three alternative drying procedures (drip, tumble, and line) and two procedures for evaluating the appearance of specimens. In addition, a hand washing procedure using drip drying is included. Either of the two evaluation procedures may be used.

The *low-angle* procedure is recommended when the primary interest is in surface smoothness. This procedure has been found to be appropriate in research and development work and in quality-control work for production finishing operations. This low-angle lighting reduces the masking effects of certain colors and patterns.

TABLE I

| *Washing procedure* | *Drying procedure* | *Evaluation procedure* |
|---|---|---|
| I Hand—105°F (41°C) | A Drip | 1 Low-angle |
| II Machine—105°F (41°C) | B Line | 2 Overhead |
| III Machine—140°F (60°C) | C Tumble | |

The *overhead* procedure emphasizes general appearance. Effects of patterns and designs which tend to mask general mussiness are appropriately evaluated by this procedure.

Table I summarizes the various washing, drying and evaluating procedures available.

## APPARATUS AND MATERIALS

Automatic washing machine having:

1) Controlled wash-water temperature settings of 105 ± 5 and 140 ± 5°F (41 ± 3 and 60 ± 3°C) with rinse-water temperature of 105 ± 5°F (41 ± 3°C).
2) Normal agitator speed no slower than 47 cycles/min.
3) Final spin speed (range 480 to 660 rpm).
4) Final spin cycle time of four to six minutes.

Automatic tumble dryer having:

1) Controlled exhaust temperature which cycles to 160°F (71°C) but does not exceed it.
2) A cooling period while tumbling five to 10 minutes at the end of the drying cycle.

A steam or dry iron with appropriate fabric temperature settings.

A lighting and evaluation area in a darkened room using either low-angle lighting and viewing arrangement as shown in Figure 1 (*1*) or overhead-lighting arrangement shown in Figure 2.

Drip- and line-drying facilities.

Soap or synthetic detergent.

Standards—

1) Three-dimensional plastic replicas or photographs (*2*) are used with low-angle lighting. Miniatures in Figure 3 should not be used as standards.

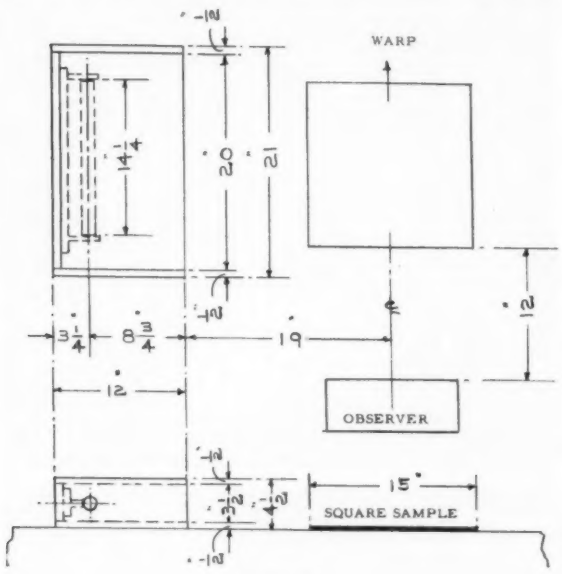



**Figure 1**
**Lighting equipment for viewing test specimens with low-angle lighting**

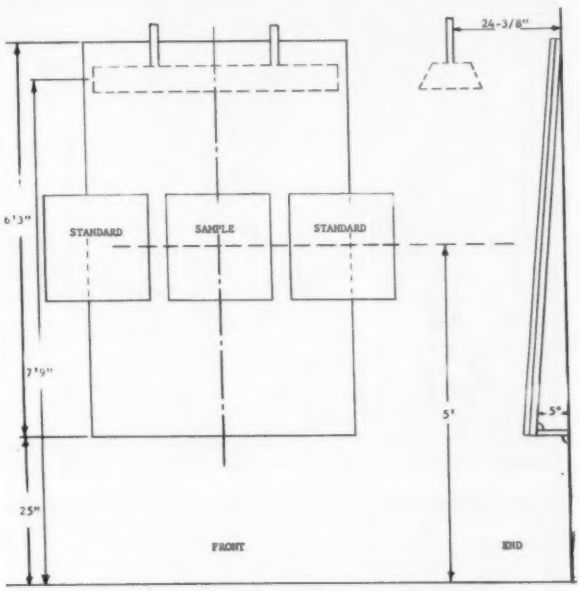



**Figure 2**
**Lighting equipment for viewing test specimens with overhead lighting**

MATERIALS LIST

1—Fluorescent light fixture # 12-15, General Electric Co or Progress Mfg Co
1—14-watt cool white fluorescent light
1—Six-foot #18-2 lamp cord
1—Electric plug
1—Feed through switch
2—#1 Marr connectors
½" × 12" clear finish white pine
½" × 5" clear finish white pine
18—One-inch #6 screws
Outside finish for box—two coats orange shellac
Inside finish—none

(Source, Cranston Print Works Co, Cranston, RI)

MATERIALS LIST

2—4′ White fluorescent tubes, 40-watt (without baffle or glass)
1—White enamel reflector (without baffle or glass)
1—General-type swatch mount, spring-loaded, fabricate using light sheet metal (22 ga)
1—¼" Plywood mounting board, OD 6'9" × 4'3". Paint gray to match No. 2 rating on International Gray Scale for Staining.

2) Photographs (3) are used with the overhead lighting. Miniatures in Figure 4 should not be used as standards.

Dummy load of 3′ × 3′ hemmed pieces of type 128 cotton sheeting, which, when added to test specimens, will make a four-pound load.

A 10-quart pail.

## TEST SPECIMENS

Prepare three test specimens (4) each 15" × 15" cut parallel to the warp and filling, pinked to prevent fraying (5) and marked to indicate the direction of the warp.

## PROCEDURES

WASHING———

I) *Hand Wash* (6). Dissolve 20 gms of neutral soap or detergent in two gallons of water at 105°F (41°C) in a 10-quart pail and then add three test specimens. Wash for a total of five minutes, lightly scrubbing the center portion of each test piece separately for a period of one minute. Rinse twice for two minutes with no twisting or wringing, using two gallons of water at 105°F (41°C). Remove the specimens and dry by one of the methods shown in Table I.

II) *Machine wash.* 105 ± 5°F (41 ±3°C).

III) *Machine wash.* 140 ± 5°F (60 ± 3°C).

Use the full water level of the washer and the indicated water temperature for the washing cycle; rinse at 105 ± 5°F (41 ± 3°C) for both washing procedures II and III. Add the test specimens and enough dummy pieces to make a four-pound load using no less than 10 dummy pieces. Add neutral soap or detergent in sufficient quantity to produce good running suds.

Set washer for a 10-minute washing time. Allow washing to proceed automatically *into the final deep rinse* cycle if drip-drying procedure A is followed. If line- or tumble-drying procedures B or C are followed, allow washing to proceed automatically *through the final spin cycle.* Remove the test specimens immediately and dry by one of the methods shown in Table I.

DRYING———

A) *Drip Dry.* Remove the specimens from pail or the automatic washer just before the water begins to drain for the final spin-dry cycle and hang each by two corners, with the warp in the vertical direction, in still air at room temperature until dry.

Repeat the washing and drying cycle four more times.

Condition by hanging each specimen by two corners with the warp in a vertical position in still air for two hours at 70 ± 2°F (21 ± 1°C), 65 ± 2% rh.

B) *Line Dry.* Remove the test specimens from the automatic washer immediately after the final spin cycle and hang each by two corners with the warp in the vertical direction in still air at room temperature until dry.

Repeat the washing and drying cycle four more times. Condition the

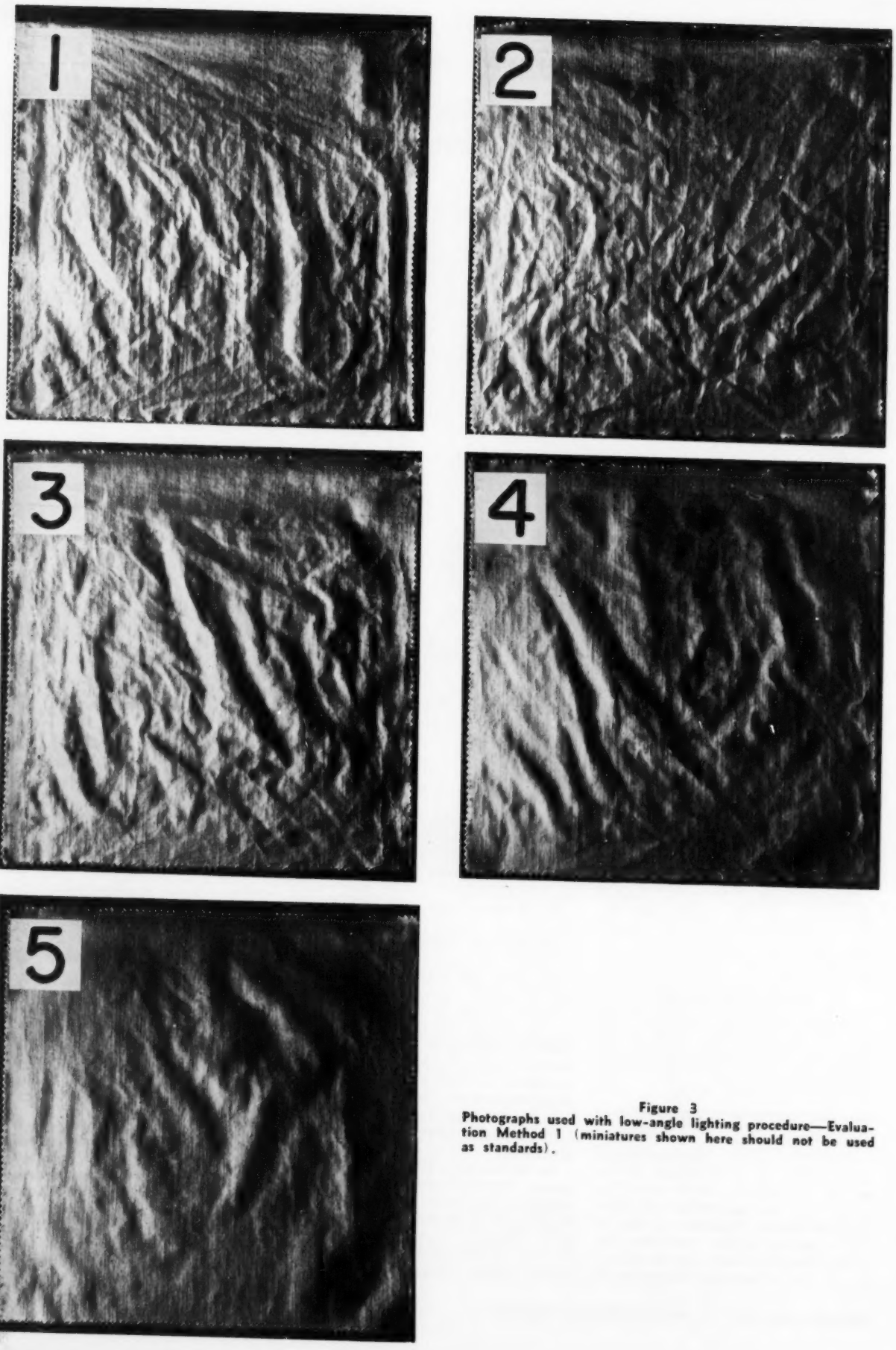
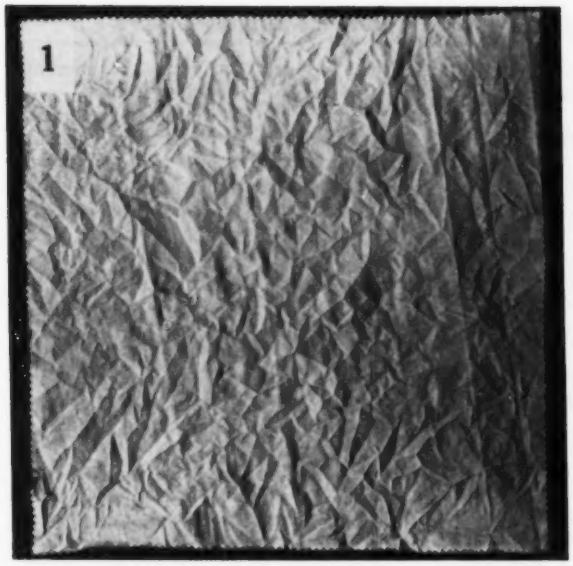
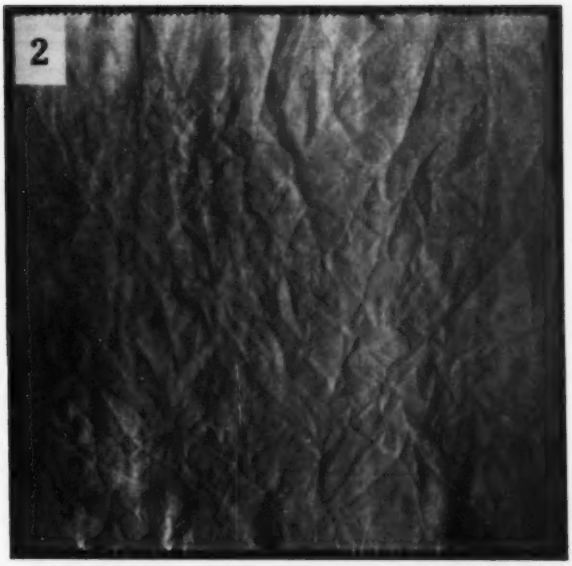
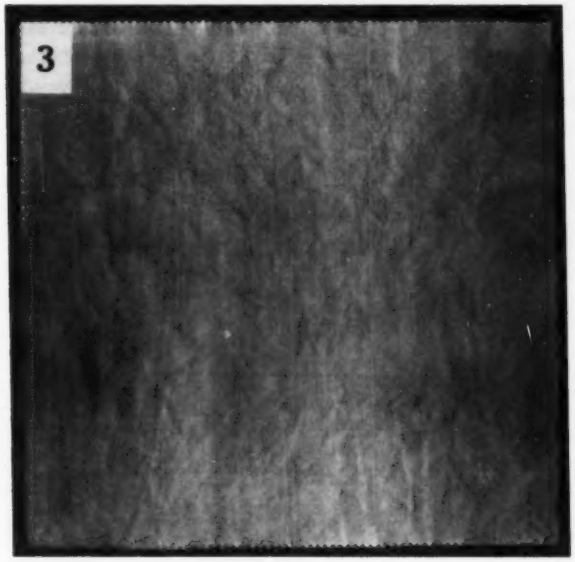
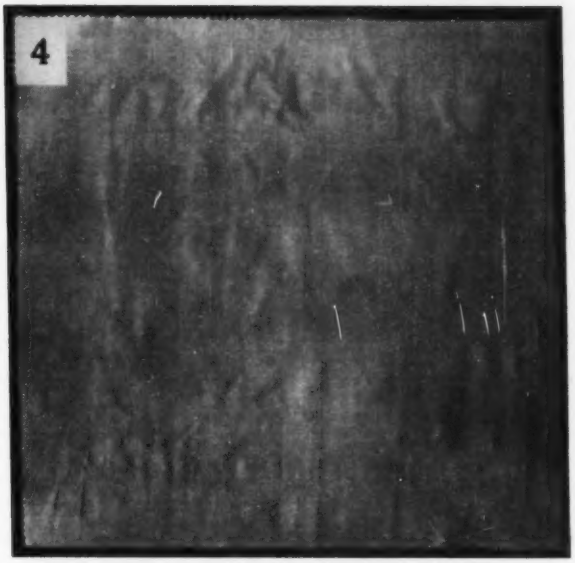



Figure 3
Photographs used with low-angle lighting procedure—Evaluation Method 1 (miniatures shown here should not be used as standards).



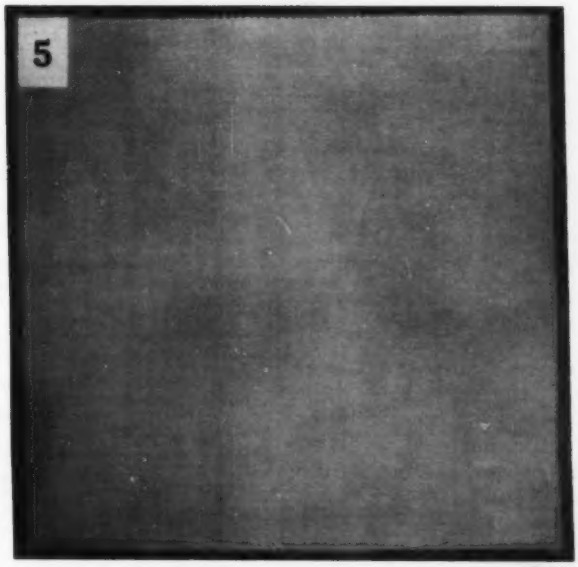




**Figure 4**
**Photographs used with overhead lighting procedure—Evaluation Method 2 (miniatures shown here should not be used as standards).**

test specimens as described in drying procedure A.

C) *Tumble Dry.* Remove the test specimens from the automatic washer immediately after the final spin cycle, separate tangled pieces and place the washed load (test specimens and dummy pieces) in the tumble drier and dry at 120 to 160°F (49 to 71°C) for 30 minutes or until dry. Continue tumbling five to 10 minutes with the heat turned off (cool-down cycle). Remove the load immediately after machine stops. Repeat the washing and drying cycle four more times. Condition the test specimens as described in drying procedure A.

## EVALUATION

Three trained observers should rate each test specimen independently using the specified evaluation procedure. Class 5 is equivalent to the #5 standard associated and seen with the evaluation procedure specified and represents the smoothest appearance and best retention of original appearance, while Class 1 is equivalent to standard 1 and represents the poorest appearance and poorest retention of original appearance.

Class 5—negligible or no change as shown in Standard 5.

Class 4—a change in appearance equivalent to Standard 4.

Class 3—a change in appearance equivalent to Standard 3.

Class 2—a change in appearance equivalent to Standard 2.

Class 1—a change in appearance equivalent to Standard 1.

1) *Low-angle Lighting.* Place the test specimen flat on a table in the manner shown in Figure 1. Similarly place the standards (either three-dimensional replicas or photographs) illustrated in Figure 3, with the base of the pattern toward the observer. When evaluating fabrics with special surface effects (textured, corduroy, tufted fabrics, etc) the three-dimensional replicas should be used, and an unwashed sample of the original fabric may be included with the test specimen and the replica standards as a reference to assist the evaluation (7). Assign the number of the standard which most nearly matches the appearance of the test specimen.

Similarly, the observer independently rates each of the other two test specimens. The other two observers proceed in the same manner assigning ratings independently.

2) *Overhead Lighting.* Mount the test specimen on the viewing board as illustrated in Figure 2. Place standard photographs (3) illustrated by Figure 4 on each side of the test specimen to facilitate comparative rating. The overhead fluorescent light should be the only light source for the viewing board. Assign the number of the standard which most nearly matches the appearance of the test specimen.

Similarly, the observer independently rates each of the other two test specimens. The other two observers proceed in the same manner assigning ratings independently.

## CALCULATION AND REPORTING RESULTS

Average the nine observations made on each test fabric (three judgments on each of three specimens). Report the average to the nearest tenth of a decimal and state the test procedure used by giving the Roman numeral defining the washing procedure, the capital letter defining the drying procedure and the Arabic number the evaluation procedure, eg, Test II-C-1.

## NOTES

(1) Source, Cranston Print Works Co, Cranston, RI.
(2) Source, Monsanto Chemical Co, Springfield 2, Mass.
(3) Source, AATCC, Box 28, Lowell, Mass.
(4) Wrinkles in test specimen should be removed by appropriate ironing prior to testing.
(5) If excessive fraying occurs in washing, specimens should be stitched loosely one-half inch from edges.
(6) Like other hand wash procedures, Procedure No. I has inherent limitations (eg, limited reproducibility of the type of action involved due to the human element).
(7) Although the test method and reference standards were originally designed for use with smooth fabrics, comprehensive interlaboratory tests have shown that they may be used with equal success to evaluate the change from original appearance of special effect fabrics.

# AATCC Calendar

**COUNCIL; NATIONAL COMMITTEES**
Sept 26 (Statler Hotel, Buffalo, NY); Council (8 PM)
Oct 26-27 (Sheraton Hotel, Philadelphia, Pa); TCR, research and administrative committees
Nov 17 (Hotel Sherman, Chicago, Ill); Council and Annual Meeting (2 PM)
Jan 26 (Hotel Commodore, New York, NY); Council (10 AM)
Apr 12-13 (Francis Marion Hotel, Charleston, SC); Council, administrative and research committees

**NATIONAL CONVENTIONS**
Sept 27-29, 1961 (Hotel Statler, Buffalo NY); Nov 14-17, 1962 (Atlanta Biltmore Hotel, Atlanta, Ga); Oct 30-Nov 2, 1963 (Boston, Mass); Oct 1-3, 1964 (Hotel Statler, New York, NY); Oct 14-16, 1965 (Conrad Hilton Hotel, Chicago, Ill); 1966 (Philadelphia, Pa)

**DELAWARE VALLEY SECTION**
Sept 15 (Wilmington, Del); Oct 27, Dec 1 (Beck's Restaurant, Philadelphia, Pa)

**MID-WEST SECTION**
Nov 18 (Chicago, Ill)

**NORTHERN NEW ENGLAND SECTION**
Sept 8 (Annual Outing, Wachusett Country Club, West Boylston, Mass); Oct 20 (Quartermaster R & E Command, Natick, Mass); Dec 18 (Motel 128, Dedham, Mass); Jan 19 (Woodlawn Country Club, Newton, Mass)

**NORTHERN PIEDMONT SECTION**
Oct 7 (Hotel Roanoke, Roanoke, Va)

**PACIFIC NORTHWEST SECTION**
Nov 10 (business meeting)

**PACIFIC SOUTHWEST SECTION**
Oct 7-8 (Annual Outing, Rancho Santa Fe, Calif.) Nov 17

**PALMETTO SECTION**
Sept 15-16 (Clemson House, Clemson, SC); Jan 20-21 (Poinsett Hotel, Greenville, SC); April 14-15, 1962 (Francis Marion Hotel, Charleston, SC)

**PIEDMONT SECTION**
Sept 23 (Hotel Barringer, Charlotte, NC); Jan 27 (Hotel Charlotte, Charlotte, NC); Apr 7 (Hotel Barringer, Charlotte, NC); June 8-9 (1962 Outing—Mayview Manor, Blowing Rock, NC); Sept 29, 1962 (Hotel Barringer, Charlotte, NC)

**RHODE ISLAND SECTION**
Sept 15 (Management Meeting); Oct 17 (Dinner Meeting); Dec 1 (Annual Business Meeting)

**SOUTH CENTRAL SECTION**
Sept (Hotel Patten—tentative)

**SOUTHEASTERN SECTION**
Sept 9 (Ida Cason Gardens, Pine Mountain, Ga); Nov 25 (Atlanta Athletic Club, Atlanta, Ga)

**WESTERN NEW ENGLAND SECTION**
Sept 15 (Plant visitation); Oct 27 (Annual Meeting) Dec 1 (Shelton, Conn)

# Employment Register

*This column is open for two insertions per year, per member, without charge. Blanks may be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.*

*61-17*

*Education:* BS textile chemistry, LTI.

*Position desired:* Textile chemistry.

*Location:* Massachusetts, Rhode Island or Eastern US.

*Age:* 24; single; references

8-21, 9-4

*Piedmont Section———*

# CONSIDERATIONS IN THE USE OF NONIONIC SURFACE-ACTIVE AGENTS*

C E COLWELL
*Technical Service Laboratory*
*Union Carbide Chemicals Co*
*Tarrytown, NY*

and

W E RIXON
*Union Carbide Chemicals Co*
*Charlotte, NC*

## INTRODUCTION

THE rapid pace of technologic growth in the surfactant industry during the last 15 years is best illustrated by the number of synthetic surface-active products developed during this period. Well over 3,000 trade name synthetic surfactants are now available and the number continues to grow at a remarkable rate. In every conceivable application where the fatty acid soaps once enjoyed dominance, synthetic products have evolved to challenge, and to a significant degree, to replace the soaps. This challenge to the soaps has come from many widely varying synthetic chemical types, which are commonly classified as anionic, nonionic, cationic and amphoteric.

To the buyer and the user of surface-active products, this expansive showcase of chemical wares is both impressive and confusing. The number available suggests that surely one product in the many will meet every requirement, but confusion reigns as the search for this product gets underway. Confusion can be lessened, however, by considering the personality traits of the individual surfactant families. The discussion that follows is directed toward better understanding of important members of the nonionic surfactant family.

## DISCUSSION

Nonionic surface-active agents embrace a wide variety of chemical compounds, which are characterized in the broadest sense by a hydrophil-hydrophobe structure devoid of ionizing potential. Typical members of all the major nonionic surfactant families are shown in Figure 1. These products account for most of the 375 MM lbs of nonionic reagents sold in 1959. In common with surfactants of all types, the nonionic surfactants have segregated areas in their molecules which are either oil-soluble (hydrophobic) or water-soluble (hydrophilic). All of the hydrophobic molecules of commercial significance in the production of nonionic surface-active agents have their counter parts in anionic production. Important members of the alkylphenol class include the octyl-, nonyl- and dodecylphenols, which are derived from petroleum products. The other types, for the most part, are derived from natural products. In all the major types, the common building block in the hydrophilic portion is ethylene oxide.

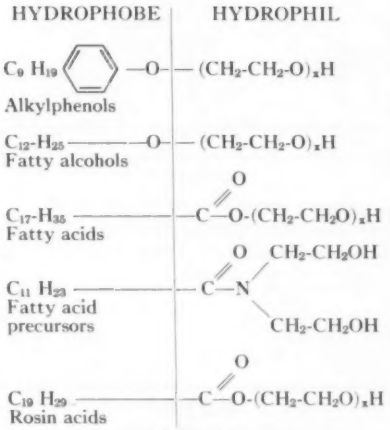



**Figure 1**
**Major nonionic surfactant types**

It is interesting to note that the polymerization products of ethylene oxide, when no hydrophobe is attached, are all water soluble regardless of the molecular weight. This solubility is attributed to the multiplicity of hydrogen bonds which are formed between water molecules and the ether oxygen groups in the polymer chain. This association reaction with water is shown in Figure 2. Ethylene oxide polymers are unique with respect to their solubility in water since neither formaldehyde nor propylene oxide produces polymers which are water soluble over a very broad molecular weight range. The

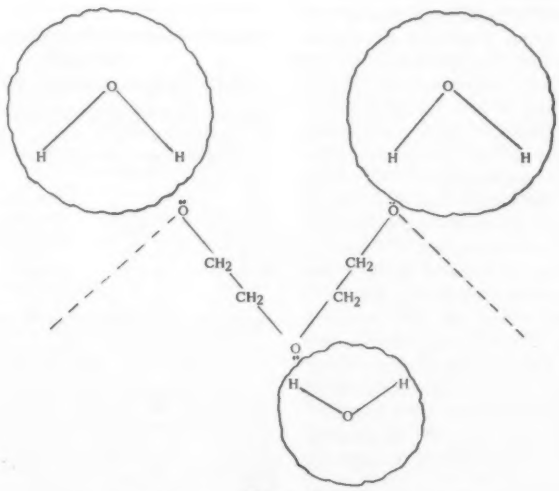



**Figure 2**
**Water solubilization of ethylene oxide polymers**

*Presented before the Piedmont Section on April 22, 1961 at the Jack Tar Hotel, Durham, NC.

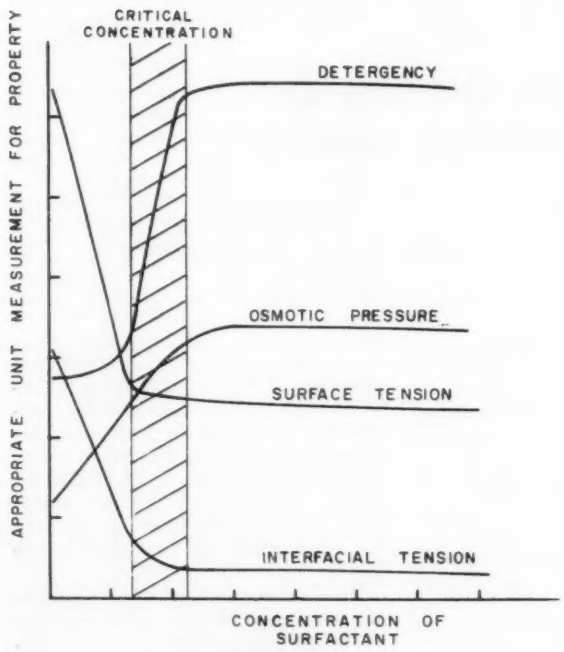



**Figure 3**
**Property changes at the CMC**

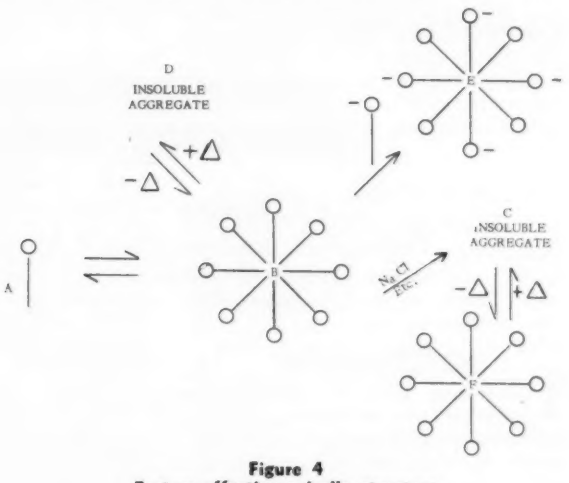



**Figure 4**
**Factors affecting micelle structure**

Carbowax† polyethylene glycols with molecular weights ranging up to 6000 are water soluble even above the boiling point of water. Polyox† water-soluble resins with molecular weights in excess of one million have a similar poly(ethylene oxide) structure and these, too, are highly water soluble.

The reaction of ethylene oxide with any of the hydrophobic alcohols, alkylphenols, or carboxylic acids combines in one molecule the properties of the separate reactants. The Tergitol† nonylphenol surfactants shown in Table I are typical products of the alkylphenol type. The only structural variation among the products is the length of the polyethylene glycol chain. As this chain lengthens the products approach the solubility characteristics of polyethylene glycol. The average length of this chain is reliably indicated by the cloud point exhibited by dilute aqueous solutions of the surfactant. When a dilute solution is heated slowly the solution becomes turbid at a temperature characteristic of the product being tested. This cloud point is indicative of a decrease in the solubility of the product at the temperature of the clouding and results from the dissociation of the water molecules linked to the ether oxygen groups in the hydrophil. Closely related Tergitol nonionic surfactants (Table II) are based on the hydrophobic molecules dodecylphenol and 2, 6, 8-trimethyl-4-nonanol. Here again, a series of products having differing solubilities results from variations in the length of the polymeric ethylene oxide hydrophil.

Up to this point we have considered the behavior of the surfactant in terms of the individual molecules. Nonionic surfactants, in common with anionic and cationic surfactants, form molecular aggregates or micelles when the surfactant concentration exceeds a definite level in the solution. This critical concentration, or critical micelle concentration (cmc) is associated with abrupt changes in many property measurements of the surfactants. From Figure 3, it can be seen that detergency—the ability of the surfactant to promote cleaning—reaches a maximum in this critical concentration range. Similarly, the maximum potential of the surfactant for lowering the surface tension and the interfacial tension is realized in this critical range. The plateau reached in the osmotic pressure curve indicates that surfactant molecules, added in excess of the critical concentration, do not lead an independent existence in the solution but become a part of a micellar aggregate. Micelle formation in the critical range is usually represented as shown in Figure 4 (A, B). The unequal attractive forces between the water molecules and the hydrophobic and hydrophilic parts of the surfactant molecule force the surfactant molecules into the aggregated arrangement shown in B.

**TABLE I**
**Tergitol nonionic surfactants**
**nonylphenol family**

$C_9H_{19}$—C$_6$H$_4$—O-($CH_2$-$CH_2O$)$_x$H

| *Tergitol surfactant* | *Hydrophil X =* | *Solubility percent by weight* | *Cloud point (°C)* |
|---|---|---|---|
| NP-14 | 4 | <0.01 | insoluble |
| NP-27 | 7 | 20 | 5 |
| TP-9 | 9 | complete | 51-56 |
| NPX | 10.5 | complete | 60-65 |
| NP-33 | 13 | complete | 88 |
| NP-35 | 15 | complete | 96 |
| NP-40 | 20 | complete | >100 |

**TABLE II**
**New Tergitol nonionic surfactants**

DODECYLPHENOL FAMILY

$C_{12}H_{25}$—C$_6$H$_4$—O-($CH_2$-$CH_2O$)$_x$H

| *Tergitol surfactant* | *Hydrophil X =* | *Solubility percent by weight* | *Cloud point (°C)* |
|---|---|---|---|
| 12-P-6 | 6 | dispersible | <0 |
| 12-P-9 | 9 | <1 | 15 to 20 |
| 12-P-12 | 12 | complete | 60-65 |
| 12-P-15 | 15 | complete | 90-95 |

TRIMETHYLNONANOL FAMILY

$(CH_3)_2$-CH-$CH_2$-CH-O-($CH_2$-$CH_2O$)$_x$H
|
CH($CH_3$)$_2$-$CH_2$-CH($CH_3$)—$CH_2$

| *Tergitol surfactant* | *Hydrophil X =* | *Solubility percent by weight* | *Cloud point (°C)* |
|---|---|---|---|
| TMN-3 | 3 | <1 | <0 |
| TMN | 6 | complete | 34 to 38 |
| TMN-10 | 10 | complete | 70 to 75 |

†Tergitol, Carbowax, and Polyox are registered trademarks of the Union Carbide Corp.

Aggregates of this type in which the alkylphenol hydrophobes are oriented to give least contact with the surrounding water phase have been reported to have molecular weights ranging up to 100,000.

Since the micelle figures prominently in the many jobs a surfactant can perform it is of interest to consider those factors which can change the hydrophil-hydrophobe balance of the nonionic colloidal aggregates.

TEMPERATURE OF USE (Figure 4, B-D)———In many of the operations in which surfactants are used, elevated temperature plays a significant role in achieving the objective. Quite often the highest temperature that is consistent with the heat tolerance of the substrate and the limitations of the equipment will be used. The choice of the proper surfactant is dictated, for the most part, by the chosen temperature of operation. The effect of temperature on the nonionic micelles is indicated in Figure 4. Maximum benefit from the surfactant will be realized by conditions which preserve the colloidal state represented by B.

A series of cotton scouring tests are shown in Table III in which various Tergitol products are compared with sodium dodecylbenzene sulfonate. The cotton cloth was heavily soiled with mineral oil and grease. Data are given in relative values with the washing power of sodium dodecylbenzene sulfonate in distilled water at 120°F being equal to 100 percent. The scouring temperature, of course, is above the cloud points of the NP-14 and NP-27 so that relatively little cleaning action occurred. Tergitol TP-9 with a cloud point at 124°F is operating at its near maximum capacity. Had the scouring temperature in this test been raised significantly above 120°F, a decrease in the performance of the Tergitol TP-9 would likewise have been noted.

EFFECT OF INORGANIC ELECTROLYTES (Figure 4, B-C)———Inorganic compounds when dissolved in the surfactant solution dehydrate the colloidal micelle to a degree dependent on the nature and the amount of inorganic material added. Table IV shows the cloud point lowering effect of various concentrations of sodium bicarbonate in two different Tergitol surfactant solutions. The effect of salt additions on the cloud point of a nonionic surfactant solution can be readily determined and appropriate surfactants can be chosen which are compatible with the salt solution at the desired operating temperature.

**TABLE III**
**Cotton scouring tests**
**Launder-Ometer tests—120°F—60 rpm**

| *Detergent* | *Comparative Detergency, %* | | |
|---|---|---|---|
| *Concentration, % by weight* | *0.1* | *0.2* | *0.3* |
| Sodium dodecylbenzene sulfonate | 100 | 100 | 100 |
| Tergitol TP-9 | 130 | 144 | 140 |
| Tergitol NP-27 | 31 | 44 | 40 |
| Tergitol NP-14 | 20 | 25 | 10 |

**TABLE IV**
**Effect of sodium bicarbonate on cloud point**

| *Percent $NaHCO_3$* | *Cloud point for 1% solution, °F* | |
|---|---|---|
| | *Tergitol NP-35* | *Tergitol NPX* |
| 0 | 212* | 148 |
| 2 | 202 | 131 |
| 4 | 186 | 120 |
| 6 | 173 | 108 |
| 8 | 160 | 95 |
| 10 | 146 | 75 |

**TABLE V**
**Scouring of woolen piece goods**
**Launder-Ometer tests**
**Distilled water, 120°F—42 rpm**

| | *Brightness relative to MgO, % Detergent concentration % by wt* | | | | |
|---|---|---|---|---|---|
| *Detergent** | *0.00* | *0.05* | *0.10* | *0.20* | *0.30* |
| Soap | 14.0 | 15.0 | 17.0 | 38.0 | 38.0 |
| Tergitol NPX | 14.0 | 68.0 | 68.0 | 68.0 | 65.5 |
| Soap four parts<br>Tergitol NPX one part | 14.0 | 56.0 | 57.0 | 61.0 | 63.0 |

*All solutions contained 0.1 percent sodium tripolyphosphate

**TABLE VI**
**Comparative lime soap dispersing power**

| *Tergitol nonionic* | *Relative values** |
|---|---|
| NP-27 | 1.1 |
| NPX | 1.0 |
| NP-35 | 1.25 |
| TMN | 1.25 |
| XD | 1.25 |
| Sodium alkyl benzene sulfonate | 7.5 |

*Relative amounts of dispersant (100 percent basic) necessary to maintain a filterable dispersion of 0.075 percent soap solution of 100 ppm calcium calcium carbonate hardness at 25°C.

**TABLE VII**
**Scouring of standard soiled cotton**
**Launder-Ometer tests—**
**Distilled water, 50°C—42 rpm**

| | *Brightness relative to MgO,% Detergent concentration % by wt* | | | | |
|---|---|---|---|---|---|
| *Detergent* | | | | | |
| Tergitol detergents | *0.00* | *0.05* | *0.10* | *0.20* | *0.30* |
| TP-9 | 22 | 33 | 40 | 41 | 44 |
| NPX 93%<br>NP-14 7% | 22 | 36 | 40 | 42 | 44 |
| NPX 78%<br>NP-27 22% | 22 | 34 | 38 | 42 | 44 |
| NP-35 38%<br>NP-14 62% | 22 | 35 | 40 | 44 | 44 |
| Low-titre soap | 22 | 29 | 35 | 42 | 45 |

EFFECT OF OTHER SURFACTANTS (Figure 4, B-E)———A mixture of Tergitol nonionic surfactant and a surfactant of differing structure will result in the formation of a mixed micelle having properties different from either pure product alone. Mixed blessings arise from such a marriage in that the desirable properties of either product may be lessened by the other component. Many anionic surfactants may form mixed micelles with the nonionic surfactant with the net result that the nonionic is solubilized beyond its optimum colloidality. As a result, its capacity to solubilize grease, disperse soil, wet fabric and perform the other functions required of a detergent will be lessened.

This effect is demonstrated by woolen piece goods scouring data shown in Table V. White woolen pieces were soiled with a mixture of lampblack, Crisco, Nujol and wheat starch. The excellent grease-dispersancy properties of the nonionic relative to soap are clearly evident. Of particular interest, is the effect of soap on the performance of the nonionic. At 0.3 percent detergent concentration where the Tergitol NPX concentration in the blend is 0.06 percent, the detergency is less than that observed with 0.05 percent NPX alone.

Nonionic admixtures with soap, however, can be extremely beneficial in preventing the deposition of soap curds in hard water. Table VI demonstrates the capactiy of various Tergitol nonionics for maintaining calcium soap in a dispersed state. It is likely that the calcium soaps formed in this process remain as an integral part of the micelle, being solubilized or dispersed by the nonionic surfactant.

Mixtures of the different Tergitol nonionics also give mixed micelles. In this case, the most significant change is in the cloud point of the resulting product. The cloud point of the mixture assumes a value intermediate to the values of the blended products but is not always proportional to the ratio of the blend. Another change resulting from blending two different nonionic products is the wide variation in viscosity for aqueous solutions of different blends. Variations in cloud point and in viscosity with different blending ratios are shown in Figure 5. The versatility of the nonionic reagents for formulating a wide range of liquid products is suggested by these relationships. Where viscosity control is of importance—whether it be functional for accurate metering of solution or for esthetic purposes such as in shampoos—blending provides a convenient plus benefit.

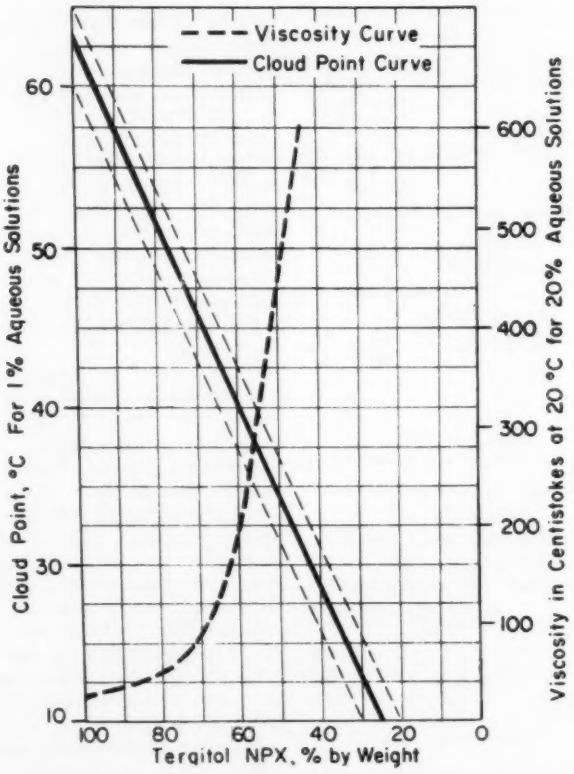



**Figure 5**
**Cloud points and viscosities of mixtures of Tergitol NPX with Tergitol NP-27**

Within limits, products blended to the same cloud point from different combinations of Tergitol nonionics, give essentially similar performance. Cotton scouring tests using standard soiled cotton cloth and widely divergent Tergitol blends all having a 50°C cloud point are summarized in Table VII. It is particularly significant to note that the NP-35:NP-14 blend gave excellent detergency even though more than a half of the blend was composed of a product which by itself is insoluble in water.

## SUMMARY

In summary, those factors which modify, inhibit or enhance the functioning of the nonylphenol-ethylene oxide surfactants have been considered. For the most part, the considerations in their use, parallel the normal and effective practices used with all surface-active materials. The inverse solubility behavior of these products, however, imposes certain limitations which can be circumvented by selecting the proper surfactant. The effects of temperature, electrolytes, solvents and other surfactants on the performance of the nonionic surfactants can be predicted or determined by experimentation and used to advantage in many industrial processes.

# Membership Applications

**August 3-16, 1961**

## NEW ENGLAND REGION

### Northern New England Section

Transfer to Senior

*William B Luce Jr*—Skein dyeing specialist, Dyecraftsmen, Inc, Hingham, Mass. Sponsors: J J O'Neil Jr, E D Desmond.

### Rhode Island Section

Junior

*Charles M Tanner*—Technical sales, Charles S Tanner Co, Providence, RI. Sponsors: W J Corney, C S Tanner.

## CENTRAL ATLANTIC REGION

### Metropolitan Section

Senior

*Nelson N Baum*—Dept mgr, styling, merchandising, selling, decorative fabrics, M Hausman & Son, Inc, New York, NY. Sponsors: W S Sims, S Schlenker.

## SOUTHERN REGION

### Northern Piedmont Section

Transfer to Senior

*Benjamin N Freshwater*—Asst supt of Dyeing, Sellers Dyeing Co, Saxapahaw, NC. Sponsors: J P McGinty, W F Blair.

### Palmetto Section

Senior

*Frederick H Duncan*—Development chemist, Excelsior Finishing Plant, Pendleton, SC. Sponsors: W V Walukewicz, E P Bebeau.

*Robert E Pruitt*—Production supt, Excelsior Worsted Mills, Inc, Pendleton, SC. Sponsors: W V Walukewicz, E P Bebeau.

### Piedmont Section

Senior

*Gus E Plakakis*—Overseer, dyeing and blending, J P Stevens & Co Inc, Rockingham, NC.

Associate

*William N Graham*—Asst overseer, dyeing and blending, Hannah Pickett Plant, J P Stevens & Co Inc, Rockingham, NC.

### South Central Section

Senior

*Molly Jo Bowling*—Lab technician A, The Chemstrand Corp, Decatur, Ala. Sponsors: J C Reno, M R Nipe.

*Theron O White*—Lab technician A, The Chemstrand Corp, Decatur, Ala. Sponsors: J C Reno, M R Nipe.

Transfer to Associate

*Robert J Robinson Jr*—Dye chemist, The Chemstrand Corp, Decatur, Ala.

### Washington Section

Senior

*Donald C Borton*—Physicist, textile research, Harris Research Labs Inc, Washington DC. Sponsors: E M Buras Jr, C G Tewksbury.

*Charles A Rader*—Chemist, Harris Research Labs Inc, Washington, DC. Sponsors: H E Harris, A E Davis.

Junior

*Eva R Choper*—Bacteriologist, Textiles & Clothing Lab, Clothing and Housing Research Div, USDA, Beltsville, Md. Sponsors: F H Forziati, E C E McNeil.

*Margaret S Dippold*—Textile tech, Harris Research Labs Inc, Washington, DC. Sponsors: V C Jackson, A E Davis.

*Grant S Edwards*—Chemist, Harris Research Labs Inc, Washington, DC. Sponsors: L E Fourt, H E Harris.

### WESTERN REGION

#### Mid-West Section

Senior

*Robert E Clark*—Mgr, Latex Dept, Spencer Chemical Co, Merriam, Kas. Sponsors: R G Perriello, D D Gagliardi.

### AT LARGE

Senior

*Enrique Wolfenson* — President, Bernardo Wolfenson SA Com y Fin, Buenos Aires, Argentina. Sponsor: D de Speluzzi.

## Elected to Membership

**August 24, 1961**

No designation after name indicates Senior
(A) indicates Associate
(J) indicates Junior
(S) indicates Student
*indicates transfer from another class of membership

### NEW ENGLAND REGION

#### Northern New England Section

*Gerald E Quinn*

### CENTRAL ATLANTIC REGION

#### Delaware Valley Section

*Chloe R Eichelberger*

#### Metropolitan Section

*David R Cooke*
*Hilda Feinberg* (A)
*Patricia R Dougherty* (J)

### SOUTHERN REGION

#### Northern Piedmont Section

*Siegfried M Kinzinger*
*Earlie S Leonard*
*Richard P Barber**
*Chia Ren Jin**

#### Piedmont Section

*Doyle R Harper*
*Lee J Slusher*
*Elbert S Mullis**

#### Southeastern Section

*Clifford M Moran*

### AT LARGE

*Frederik G Derk Meijer*
*Rolf Gross*
*Kazuo Kondo*
*Carlos Bueno* (A)

## 1961 CONVENTION EXECUTIVE COMMITTEE AT WORK

**L to r: Salvatore J Puliafico, National Aniline Div, finance; J E Loughlin, National Aniline Div, national councilor, Niagara Frontier Section; William H Leyking, National Aniline Div, Convention chairman; Thomas R Foltz Jr, Lockport Felt Co, technical programs; Nicholas J Mohoruk, Hamilton Cotton Co, Ltd, Convention vice chairman; Anton M Viditz-Ward, National Aniline Div, chairman, Niagara Frontier Section; Kenneth A Lister, Canadian Industries, Ltd, entertainment; Daniel E Boland, Western Electric Co, publicity; Holger S Thuemmel, National Aniline Div, printing**

**L to r: John C Mansfield, Mohawk Mills Ltd, president, Ontario Section, Canadian Association of Textile Colourists and Chemists; William H Leyking, National Aniline Div, Convention chairman; Anton M Viditz-Ward, National Aniline Div, chairman, Niagara Frontier Section; Holger S Thuemmel, National Aniline Div, printing**

**L to r: Daniel E Boland, Western Electric Co, publicity; Salvatore J Puliafico, National Aniline Div, finance; Kenneth A Lister, Canadian Industries, Ltd, entertainment; Nicholas J Mohoruk, Hamilton Cotton Co, Ltd, Convention vice chairman; Thomas R Foltz Jr, Lockport Felt Co, technical programs**

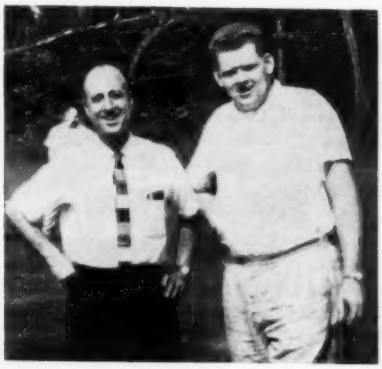
**Standing, l to r: James F Best, National Aniline Div, hotel & reservations; Neil J Battistelli, National Aniline Div, registration. Seated, l to r: William H Leyking, National Aniline Div, Convention chairman; Zane S Messinger, National Aniline Div, dining; William K McCusker, Stauffer-Dobbie Mfg Co, hotel & reservations**

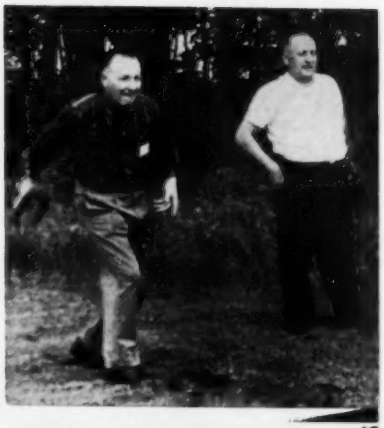
## 13th Annual Outing and Golf Tournament

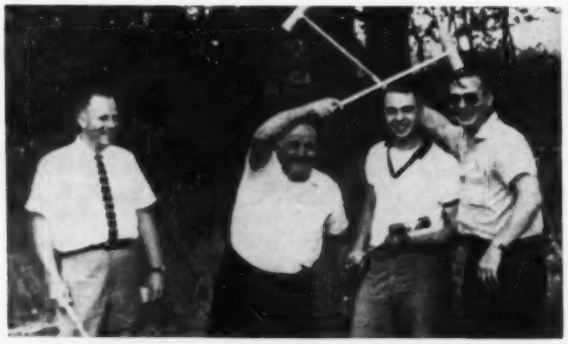
## HUDSON-MOHAWK SECTION

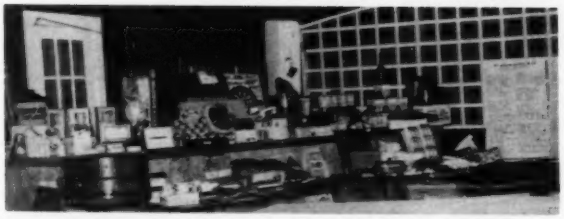
June 23, 1961 • Antlers Country Club, Tribes Hill, NY

(See report on page 51 of August 21 issue)









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Your prepaid subscription received promptly will insure your possession of this LIMITED EDITION, a tremendously valuable work on the free world's dyestuffs and pigments in commercial use. Published by The Society of Dyers and Colourists and the American Association of Textile Chemists and Colorists, these four volumes totaling 3152 pages provide the only complete reference of coloring matters available to those interested in this field. They include information on methods of application and fastness properties of coloring matters furnished by world manufacturers, chemical and structural information, characteristic reaction, index of products and trade names, fastness tests and rating methods, new and old COLOUR INDEX NUMBERS, Schultz and AATCC prototype numbers and a hue indication chart.

---

**Orders in the United States, Mexico, Central and South America (excluding British possessions) should be placed with—**

***American Association of Textile Chemists and Colorists***
***PO Box 28, Lowell, Massachusetts***

---

**Orders in other countries should be placed with—**

***The Society of Dyers and Colourists***
***19 Piccadilly, Bradford, Yorks, England***

# COLOUR INDEX HUE INDICATION CHARTS AVAILABLE FROM NATIONAL HEADQUARTERS

Copies of the *Colour Index* Hue Indication Chart are now available from National Headquarters at a price of $1.50 per copy.

The most important property of any coloring matter is its hue on a given substrate. The coloring matters in each usage section of Part I of the *Colour Index* have therefore been subdivided into a regular series of hue groups for which the conventional descriptions yellow, orange, red, violet, blue, green, brown and black (with the addition of white in the section devoted to pigments) have been adopted. This classification has been incorporated in the system of serial usage numbers in Part I. Each entry carries a reference number, eg, CI Acid Yellow 1 or CI Vat Blue 20; these numbers are consecutive within each hue group and will be extended as supplementary volumes appear. The commercial name under which a coloring matter is marketed does not necessarily give a precise indication of its hue. This is well illustrated by the wide divergence which frequently occurs in the commercial names used by different manufacturers for the same coloring matter. To overcome these inconsistencies and to introduce some measure of standardization a *Hue Indication Chart* was devised. This chart, in the shape of a hexagon, gives prominence to the six major divisions of alternate primary and secondary hues and at the same time provides continuity. Each side of the hexagon is divided into three parts, eg, the yellows are divided into greenish yellow, yellow and reddish yellow. The tertiary hues are placed inside the area of the primary and secondary hues and in association with the parent hues. A neutral grey occupies the center of the hexagon with four radial grey patterns forming a link with the other tertiary hues. Special provision has been made for pinks which are placed adjacent to the reds but outside the hexagon. Cooperating dye and pigment manufacturers were asked to describe the hue of each of their products in accordance with this hue Indication Chart, which is contained in a pocket in Volume 4. In the Chart there is an outline diagram which records the formal descriptions associated with the individual chromatic areas. Each chromatic area is designated by an outline which functions as a line of demarcation between the different areas. Many of the chromatic areas are qualified by the terms bright and dull.

This Chart enables a reader to translate into visual terms the verbal descriptions of hue given in the *Colour Index*.

# NOTICE TO AUTHORS OF PAPERS

MANUSCRIPTS for the *Proceedings* of the American Association of Textile Chemists and Colorists shall conform to the requirements and standards given in this *Notice*. Before publication, manuscripts for the *Proceedings* shall be approved by the Editor, not only for editorial correctness according to the standards of this *Notice*, but also for content of technical matter. In his work, the Editor may enlist the aid of anonymous reviewers who are selected for expert knowledge in particular fields.

It is presumed that authors in studying the comments of reviewers and of the Editor will remember that all recommendations are made in a kindly, helpful, sympathetic manner to improve the paper in both literary and technical excellence. Although authors should cheerfully consider suggestions, they are expected to defend their position if justified, especially when strictly technical matters are involved with which the authors have an intimate knowledge.

AATCC strives to maintain a high scientific and professional standard for papers. Authors must make every effort to avoid the use of trade names, commercial products or process names wherever such use may be construed as advertising. Wherever possible, scientific nomenclature must be employed eg, *Colour Index* designations for dyestuffs and pigments in place of the trade names. It is recognized that in some instances trade names are necessary to avoid lengthy description. Certain trade names have been so widely used as to become generic and these normally are permissable. Further, some technical papers may involve the presentation of a new product or process wherein trade name reference is obligatory.

Giving due consideration to such valid exceptions, it is incumbent upon the author to maintain the proper scientific attitude, avoiding any expressions or devices aimed at promoting a particular product or process.

Questionable papers are to be referred to the chairman of the Publications Committee, who will submit them to an editorial board which would be appointed as needed. The Board would report to the Publications Committee, which would have the final voice in accepting or reject-in a paper.

MANUSCRIPTS — Manuscripts shall be typewritten double-spaced with approximately one-inch margins on 8.5x11-inch white paper. In addition to the *original*, at least one carbon copy is required. Pages are to be numbered consecutively with Arabic numerals, and each page after the first shall carry the authorship at the very top. Tables and figures shall also be numbered consecutively, the tables with headings containing Roman numerals as TABLE I, TABLE II, etc, and the figures with Arabic numerals as Figure 1, Figure 2, etc, appearing *below* the figures. The names of the authors and their laboratories or business connections should appear below the title of the paper.

LITERARY STYLE AND FORM OF PRESENTATION—In the writing of papers, authors are requested to observe a trenchant, simple style of writing directed to textile chemists and colorists with at least an elementary knowledge of chemistry, physics, mathematics, engineering, textile processes and textile machinery.

In the organization of the material, there should be one or more introductory paragraphs setting forth the occasion, significance and main objectives of the paper and of the method of attack. This should be followed by the body of the presentation, either with discussions interspersed throughout this portion or with a collected section marked "DISCUSSION" after the main body of the paper. Finally, there may be a brief section at the end entitled "SUMMARY" or "CONCLUSIONS."

Center and side headings make for easier reading. Center headings should be employed sparingly and generally will include only very important section headings, such as "INTRODUCTION," "EXPERIMENTAL," "DISCUSSION," "CONCLUSIONS," "SUMMARY," and "REFERENCES." Side headings (see sixth paragraph of this *Notice* for an example) shall be indented and run into the text to which they apply, and shall be separated from the paragraph by a dash. The publisher will print center headings in bold-face capitals and side headings in capitals.

LITERATURE REFERENCES AND FOOTNOTES—References to the literature and all footnotes (except those in tables) shall be numbered consecutively with underlined Arabic numerals in parentheses at the proper place in the text. Where a reference or footnote is to be used again, the original number is simply repeated; this obviates the necessity of repeating the footnote or reference at the bottom of the page. References to the literature shall conform to the universal usages followed by *Chemical Abstracts*, which include underlining of journal names to indicate italicization in printing. The abbreviated codes for many journal names appear on page 183 of the 1959 *Technical Manual*.

The spelling and rules of punctuation followed in manuscripts shall be those found in the "Merriam-Webster New International Dictionary"; abbreviations and chemical formulas shall conform to *Chemical Abstracts*.

FIGURE AND GRAPHS—Figures and graphs should be black line drawings on white drawing paper. Photographic prints are acceptable, preferably glossy prints on double-weight paper. Duplicates should be available for dispatch to reviewers. In graphs the frame and actual curves should be inked more heavily than the co-ordinate lines, and these latter should not be too close together. Various styles of broken lines are sometimes desirable to distinguish curves. Experimental points should be given with small plane figures, such as circles, squares, diamonds, or triangles. Numbers and legends on co-ordinate axes are to be lettered in the graph by the author. Number and titles of figures should be placed below the diagram or on the edge of the back. Each piece of illustration copy should bear on the margin or on the edge of the back the name of the author and the title of the paper.

SYNOPSIS—A separately written synopsis of not over 200 words containing the gist of the subject matter must accompany every manuscript.

GALLEY PROOFS—Galley proofs will be sent to the author by the publisher for correction before publication.

AUTHOR'S COPIES—Fifty copies of papers published in the *Proceedings* will be furnished without charge by the publisher if requested when galley proofs are returned. These copies are printed on one side of the sheet only and then stapled together. A schedule of prices of reprints in the usual form accompanies the galley proofs.

OWNERSHIP OF COPYRIGHTS AND PATENTS—All papers presented at general meetings of the Association or at meetings of any of its local sections and all communications shall become the property of the Association. Such papers are not to be published elsewhere until they have appeared in the *Proceedings* of the Association. Papers published in the *Proceedings* are copyrighted by the Association. Any patentable disclosures shall of course remain the property of the author or authors.

TRADEMARKS—As the AATCC wishes to co-operate in the protection of trademarks, it is requested that, in the body of the article, trademarks be written with an initial capital letter.

# New Xenon Arc Fade-Ometer and Weather-Ometer

A new light source, the Xenon Arc, with accompanying control equipment, is now available in the Weather-Ometer and Fade-Ometer.

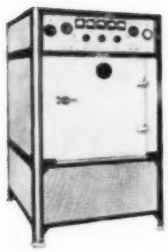
With a spectral energy distribution very close to that of natural sunlight, the Xenon lamp is ideal for use as the source of radiation in accelerated fading and weathering machines. The lamp employed in these new machines is a 6000 watt water cooled Xenon lamp which provides sufficient intensity to permit simultaneous exposure of a large number of samples of a generous size. The specimen rack of these machines has a diameter of 37¾" and will accommodate up to 54 specimens 3" x 9" in size.

These new Xenon arc machines, like the carbon arc type of Weather-Ometer, provide automatic control of black panel temperature, cycles, etc. and are also available with automatic control of humidity during both the light-on and light-off periods of the cycle.

This Xenon lamp is also available with constant wattage transformers which insure a uniform radiation intensity regardless of variations in line voltage. Control equipment is provided which permits increasing the wattage of the lamp to compensate for the progressive loss of intensity as the lamp ages. These lamps have an anticipated useful life of 2000 hours and are of the replaceable burner type so that only the burner tube and not the complete lamp is replaced.

These new Xenon Arc Fade-Ometers and Weather-Ometers do not replace our present line of carbon arc machines but are offered as a companion line of machines for those who desire the improved spectral distribution.

*Complete information with prices available upon request*



Weather-Ometer®
$2755 up.

Fade-Ometer®
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Complete with supplies.

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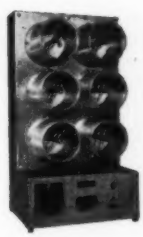

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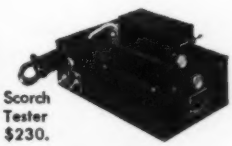

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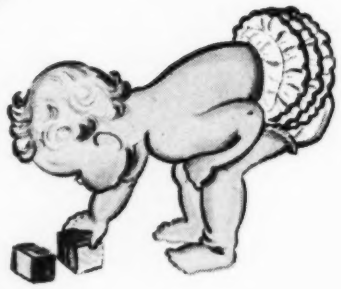
# Moropol 762



**non-soil**
**retentive**
**durable**
**non-ionic**
**resin softener**

Moropol 762 increases tear strength and abrasion resistance, and adds to the crease angle in resin treated fabrics. These properties are durable for the life of the fabric.

The "hand" imparted by Moropol 762 as a resin softener is silkier than with other durable softeners, and is excellent for fabrics like women's apparel. It does not contribute to the pickup of soil and will not retain soil or dirt during laundering, as do many thermoplastic resin softeners. This feature recommends its use on white goods in preference to acrylate, silicone, and polyethylene softeners.

**General Properties**

| | |
|---|---|
| **Chemical Nature:** | An aqueous non-ionic dispersion of an epoxy type plasticizer. |
| **Appearance:** | Creamy white emulsion |
| **Concentration:** | 40% |
| **pH:** | 6.0 - 6.5 |
| **Compatability:** | Compatible with water phase resin solutions as well as cationic, acid, alkaline, and metal salt additives. |
| **Stability:** | Freeze-thaw and storage stable for over 6 months. |

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CHEMICAL PRODUCTS, INC.

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General News of the Industry
Personalities in the News
New Products, Developments, Processes

## Fiber Society to Meet at West Point for Fall Meeting

Annual membership meeting, election of officers and presentation of eight technical papers will highlight the fall meeting of The Fiber Society, Oct 11-13 at the U S Hotel Thayer, West Point, NY.

Arrangements for the technical sessions are being handled by E I Valko, Lowell Technological Institute, chairman; Richard O Steele, Rohm & Haas Co; and George M Bryant, Union Carbide Chemicals Co.

Meetings of the Society are open to all persons who are interested in the advancement of scientific knowledge pertaining to fibers, fiber products and fibrous materials. Nonmembers can receive advance credentials by contacting Julian S Jacobs, secretary of the Society, Box 405, Athens, Ga.

Session chairmen, subjects and speakers include:

*Thursday morning*—Arnold Sookne, Harris Research Laboratories, chairman. "Effect of Fiber Tension in the Resin Treatment of Cottons," Ludwig Rebenfeld, Textile Research Institute. "Crosslinking of Cellulose with Polyfunctional Sulfones under Anhydrous Conditions," Giuliana C Tesoro, Central Research Laboratory, J P Stevens & Co.

*Thursday Afternoon*—Walter Hamburger, Fabric Research Laboratories Inc, chairman. "High-speed Test Behavior of Textile Structures", S K Batra, J G Krizik and Stanley Backer, Slater Memorial Laboratory, Massachusetts Institute of Technology. "High-speed Tensile Testing of Single Fibers", Henry M Morgan and Robert J Coskren, Fabric Research Laboratories Inc, and Sheldon Sprague and Robert Singleton, Celanese Corp of America.

*Friday Morning*—Henry E Millson, American Cyanamid Co, chairman. "Equilibrium Absorption Studies of Cationic Dyes on Acrylic Polymers and Fibers", C A Bowers and T H Guion, The Chemstrand Corp. "Multivariable Investigation of the Spinning of a Mixed Polymer System", C K Morbey and J C Whitwell, Textile Research Institute and School of Engineering, Princeton Univ.

*Friday Afternoon*—Wayne A Sisson, American Viscose Corp, chairman. "The Influence of Wet-spinning Variables on the Physical Properties of a Modacrylic Fiber", S P Hersh, T D Higgins and H W Krause, Research Dept, Union Carbide Chemicals Co. "The Influence of Coagulation Variables on the Structure and Physical Properties of an Experimental Acrylic Fiber", John P Knudsen, Chemstrand Research Center Inc.

The slate of candidates for offices for 1961-62, nominated by the Society's Governing Council at its meeting last April, include: John H Dillon, Textile Research Institute, president; Earl V Painter, Filter Products Div, Johnson & Johnson, vice president; Hugh M Brown, research consultant, treasurer (incumbent), and Julian S Jacobs, secretary (incumbent). For the Governing Council, nominees are: Bruno Roberts, Chemstrand Research Center Inc and Helmut R Wakeham, Philip Morris Research Center.

The annual meeting and election of officers is scheduled for 4 pm Thursday. Banquet speaker will be Jacques Andre Istel, who has been instrumental in introducing the sport of parachuting in the US.

The Governing Council meeting will be held Wednesday before the technical sessions.

Meetings scheduled by the Fiber Society following the fall 1961 session at West Point include:

April 11-13, 1962—Raleigh and Durham, NC, joint meeting with the Textile Division of the ASME.

Oct 10-12, 1962—Boston and Natick, Mass, Quartermaster Command, host.

May 8-10, 1963—Charlottesville, Va, Institute of Textile Technology, host.

Oct 23-25, 1963—Seaview Country Club, Absecon, NJ.

●

## Carbide's Brownsville Plant in Production

Union Carbide Chemical Co has announced the beginning of production at its Brownsville, Texas plant. The first major chemical being produced is acetic acid, with acetic anhydride and methyl ethyl ketone also scheduled for production. While these three chemicals reportedly will be made in large quantities to fill the demands of the current chemical market, the possibility of the production of additional chemicals at the Brownsville plant is also being studied by the Company.

The Company's eighth chemical plant and its third in Texas is located on a 306-acre tract and is reported to be well located with respect to both raw materials and markets. The plant and its storage terminal, on deep water, enable manufactured products to be shipped by tanker to coastal distribution centers and by barge up the Mississippi and Ohio rivers.

●

## Alliance to Open Charlotte Facilities in October

Alliance Chemical Corp, Newark, NJ, has announced October 1961 as the expected opening date for an office, laboratory, and warehouse now being built at 3710 Northmore St, Charlotte, NC. Alliance, which specializes in the manufacture of azoic dyes and their components, has established the new facilities "to assure speedy pickup and delivery to all points in the South," and to serve additionally as a distributing point for organic intermediates which the company makes in Newark.

The latest models of textile dyeing and printing machines, as well as the necessary apparatus for evaluation of colorfastness and shade matching, reportedly will be installed in the laboratory. An air-conditioned vault storing 50,000 lbs of Azoene fast color salts is being constructed in the warehouse.

To prevent shade change loss of strength which otherwise might occur during prolonged storage, Azogen printing colors will be manufactured on customer order in special mixing tanks. Custom colors will also be available from these units.

Plans for the expansion of the Company's sales force in the Southern territory will be announced shortly, it is reported.

●

## Frankl Adds to List of Representations

Ernest L Frankl Associates Inc, 515 Madison Ave, New York 22, NY, agents and importers of European textile machinery, has added four new accounts to its list of representations.

The new firms represented by Frankl are:

Ateliers Raxhon, Theux Lez-Verviers, Belgium; Stork & Co's Apparatenfabriek NV, Amsterdam, Holland; Croon & Lucke GmbH, Koeln-Ehrenfeld, Germany; and Scholl AG, Zofingen, Switzerland.

Ateliers Raxhon manufactures a complete line of wool dry-finishing equipment. Said to be of particular interest to the American market is the Raxhon shearing machine, which employs a vacuum system to raise the pile of the cloth and assure an even cut over the full width of the fabrics. Raxhon also features a continuous decating machine, believed to be the first machine of this type offered on the American market. The continuous decater reportedly permits the installation of a continuous wool finishing range, including tenter dryers, shears, cylinder presses, decating and conditioning machines.

Stork & Co's Apparatenfabriek is a branch of one of the largest industrial combines in the Netherlands and offers a complete line of wet-finishing machines. Frankl will initially stress the sale of the Stork screen printing machine and the Stork label screen printing machine, of which several units are in operation in this country.

Croon & Lucke specializes in the manufacturing of skein- and ball-winding machines, which are of interest to the stretch and bulk yarn industries. Croon & Lucke's skein-reeling machine reportedly permits the winding from cones to skeins under controlled tension which, when relaxed at doffing, reduces the skeins into "muffs" suitable for dyeing.

Scholl AG manufactures a complete line of package- and

skein-dyeing equipment, including high-temperature machines.

Frankl also represents the following firms: Sant' Andrea Novara, Novara, Italy; Jakob Muller, Frick, Switzerland; Ateliers Houget, Verviers, Belgium; Jakob Jaeggli & Cie, Winterthur, Switzerland (skein mercerizing and hydraulic beam jacks); Svetema, Gothenburg, Sweden (Pad-Roll dyeing and bleaching ranges); and Tattersall & Holdworth's, Enschede, Holland (laboratory dyeing machinery).

•

## Leeban Color & Chemical Acquires Fezandie & Sperrle

Leeben Color & Chemical Co, Inc, 103 Lafayette St, New York 13, NY, has acquired Fezandie & Sperrle, Inc, also of New York, a large-scale importer and blender of dyes and colors since 1854.

F & S, which will operate as a separate division of Leeben Color & Chemical, offers pigments, oxides, lakes and toners for various uses. Its entire staff and facilities have been consolidated with Leeben's.

In the future, Fezandie & Sperrle will also handle the certified colors and Leeben will handle the oxides, lakes and toners in addition to its regular line.

## PCTS to Continue 3-Year Basic Science Program

The three-year basic science program initiated three years ago in cooperation with Drexel Evening College and leading to engineering degrees will again be offered by the Philadelphia College of Textiles and Science in the coming fall semester.

Qualified students successfully completing this program may continue for a degree at Drexel.

In addition, PCTS will offer a variety of undergraduate evening programs, for credit, in plastics, polymer science, chemistry and industrial management. Noncredit courses are also available in textiles, plastics, and textile chemistry. Other noncredit remedial and refresher courses will be offered in reading, English and mathematics for those students entering the preengineering program whose qualification tests reveal a need for much extra work. These courses will also be open to others who may have an interest in preparing for general undergraduate study.

Three additional courses of study leading to the BS degree in Business Administration, Chemistry, and Textile Management and Marketing will also be offered. PCTS has been awarding the BS degree in the day school since 1941, but this will mark the first time that the degree will be obtainable in the evening school.

# PERSONALITIES IN THE NEWS

Sullivan

Seifert

Stafford

Duncan

*Roger L Sullivan* has been appointed manager of the new hydrogen peroxide production plant to be erected in South Charleston, W Va, by Becco Chemical Division of FMC Corporation.

Mr Sullivan has been with Becco since 1951, most recently as production superintendent of the Division's main plant in Buffalo, NY.

Plans to construct the new multimillion dollar plant were announced recently by Ernest Hart, director and former president of FMC Corp, at ceremonies marking the handing over of the former South Charleston Naval Ordnance Plant to FMC.

•

The appointment of *Hans Seifert*, Sandoz technical sales representative, to the position of sales manager, Chemical Division, has been announced. Mr Seifert will be responsible for all chemical sales of the company.

Mr Seifert has, since 1951, been active for Sandoz, Inc, in the development and introduction of new chemical products for the textile and paper industries. From 1946 to 1951, he was with Sandoz, Ltd, Basle, Switzerland. For the Swiss company, he called on textile and paper mills throughout Europe as well as those in Brazil.

•

*Robert P Jones*, New England division manager of Oakite Products, Inc, since 1954, has been assigned to the New York headquarters of the firm, which manufactures industrial cleaning and metal-treating compounds. Mr Jones, whose experience includes purchasing and accounting as well as sales, will do staff work for the firm, reporting directly to the president, *John A Carter*.

Mr Jones is succeeded in his New England post by *Roger R Heroux*, formerly the company's representative in Springfield, Mass.

*John R Stafford*, sales engineer for Turbo Machine Co, Lansdale, Pa, has been named to head the company's new Southern sales and service offices located in Charlotte, NC. Before joining Turbo in 1955, Mr Stafford worked for Textile Machine Works, Reading, Pa, and Synthane Corp, Oaks, Pa.

The new Southern sales office reportedly is equipped to handle sales and service on Turbo staplers, crimpers, fiber setters, finishing machines, tubular knit processing machines, skein- and package-dyeing machines, and the Turbo dye boarder.

•

The Southern Utilization Research and Development Division of the US Department of Agriculture has announced the appointment of an adviser, *Brooke H Duncan II*.

Mr Duncan is vice president and general manager of The Foster Co, Inc, New Orleans, serving in a similar capacity with its subsidiary, Foster Canvas Products Co, and is secretary-treasurer of Foster Aluminum Awning Co. A member of the board of directors of Canvas Products Association International, with which the Southern Division has worked closely in a program of cooperative research on the improvement of cotton awnings and awning materials, Mr Duncan will advise the Division on research in this area. The research is aimed at finding better treatments for canvas and other cotton products to reduce deterioration by weathering and damage from mildew and rot.

•

Appointment of *John L Rourke* as assistant manager of the Syracuse plant of its Solvay Process Division was recently announced by Allied Chemical Corp. In his new assignment, Mr Rourke will assist in the management of one of the world's largest soda ash plants. Prior to his present appointment, Mr Rourke had been assistant manager of Solvay's Moundsville, W Va, plant.

# REPRINTS

## from AMERICAN DYESTUFF REPORTER

The following technical articles—reprinted from recent issues of American Dyestuff Reporter—are available in limited quantity, at prices shown. Send check, money order, or stamps to address below:

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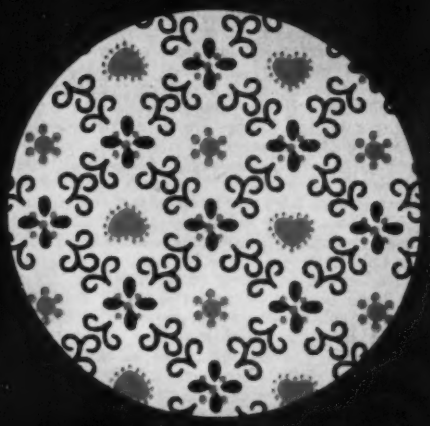

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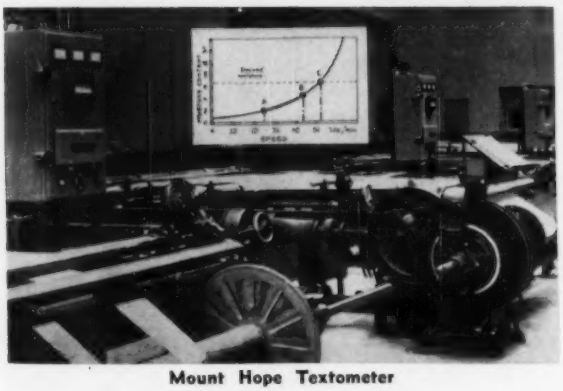


Mount Hope Textometer

## Mount Hope Textometer

The Mount Hope Textometer, available with either manual or automatic controls, measures moisture by electrical conductivity. The unit, developed by the Mount Hope Machine Company, Inc, Taunton, Mass, is expected to eliminate costly excess drying as well as problems caused by over-damp fabrics and the present need for constant tending of machinery. By eliminating over-drying, machine speeds may reportedly be increased to turn out more yardage with lower steam consumption per yard.

Since residual moisture increases with machine speeds, the automatic Textometer, upon electrode detection of moisture deviation, adjusts rate of speed of fabrics coming from slashing machine, tenter frame or dryer. Changes in moisture reportedly trigger direct action, because resistance in thousands of ohms changes drastically with even minimal increase or decrease in moisture percentages. For example, cotton with 3.5% moisture is said to have resistance of 100,000,000 ohms; 4.5% moisture—10,000; 12%, only 1,000. Other fabrics reportedly show corresponding behavior patterns.

The electrodes are mounted on an arm or bar near the end of the dryer or just beyond the tenter frame or slashing machine at points across the breadth of the warp. As the electrodes sense residual moisture, they transmit the information to the Textometer panel in the case of automatically operated units. The speed of the machine is then automatically adjusted to produce the desired moisture. In the case of the manual units, an optical telindicator panel indicates the condition of the fabric. A flashing green signals dry, a stable yellow means optimum moisture, a flashing red means moist. (The light panel may be included with automatic units to give quick visual performance information.)

An optical line or point recorder may be included to record the material quality, moisture content, downtime, and changes in machine speed.

When the machinery is idle, the Textometer automatically cuts off. At startup, it adjusts automatically to startup moisture content, forcing the machine to operate at higher speeds until the fabric reaches the desired moisture content level.

A portable Textometer, battery-powered for use in company laboratories, store rooms or plants proper, is also available from Mount Hope Machine Co. It may be equipped with any one or all of six types of prong-, crest-, and contact-type electrodes.

●

## Four New Epolenes

Adding to its line of Epolene low-molecular-weight polyolefin resins, Eastman Chemical Products, Inc, subsidiary of Eastman Kodak Co, recently announced the commercial availability of four new types, Epolene C-11, Epolene C-12, Epolene E-13, and Epolene E-14. This brings to a total of twelve the number of different Epolene resins offered by Eastman.

Type E-14, an emulsifiable Epolene, with low softening point, is said to meet the requirements for an easy-to-melt, easy-to-handle polyolefin for use in textile emulsions. It may be emulsified by either the water-to-wax or wax-to-water method.

Completing the list are Epolene E-13, specifically developed for use in paraffin blends; Epolene C-12, a low cloud point flexible resin; and Epolene C-11, said to be a high-density (.947) non-emulsifiable polyolefin resin with excellent greaseproofness, film strength, and low temperature flexibility, and primarily designed as a modifying resin for use with low-molecular-weight polyethylene, polyterpenes, and hydrocarbons.

Bulletin No. F-110 "Epolene low-molecular-weight polyolefins—properties and applications" may be obtained by writing to Eastman at Kingsport, Tenn.

●

## Four New Foron Dyes

Release of four new disperse dyes in the Foron line has been announced by Sandoz, Inc. All are said to be suitable for use on polyester fibers, and to be superior in fastness to any available dyes similar in shade.

The four are: Foron Red FL ultra-dispersed pat, termed by Sandoz "the first true, full red" (in disperse dyes) with all-around fastness properties; Foron Rubine GFL ultra-dispersed, a rubine which is said to be fast to light, washing, sublimation, perspiration, pleating, and drycleaning; Foron Scarlet BWFL ultra-dispersed paf, a bluish scarlet with a reported daylight fastness of L 6-7; Foron Yellow Brown 2RFL ultra-dispersed pat, which is being recommended by Sandoz as a base color for tan or brown shades on polyester and polyester/wool blends. The red, rubine, and scarlet are said to be suitable for high-temperature dyeing.

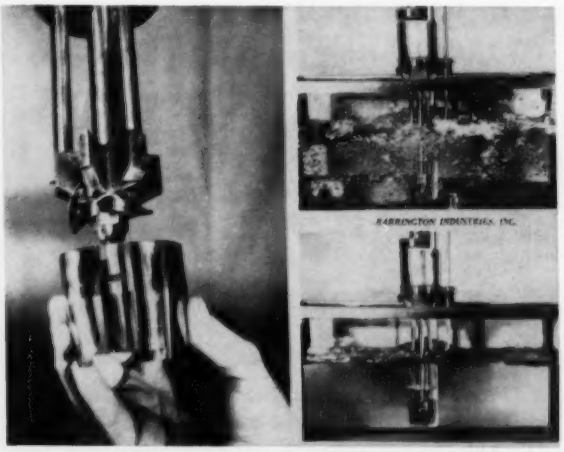
●

## Convertible Mixers

A complete line of standard portable and stationary mixers equipped with a convertible feature for use as either open or closed turbine units is being offered by Barrington Industries, Inc, 185 Union Ave, Providence 9, RI. These stainless-steel units are said to be widely used in installations including emulsification and dispersion of low- and high-viscosity materials, and thixotropic materials of hundreds of thousands of cps in the textile and other industries.

Normally, open-turbine applications include mixing highly thixotropic material, breaking the structure of gel-like materials and liquifying and dispersing pigment press cakes. Used for open-turbine operation, the Barrington units are said to mix and blend materials by moving them simultaneously, vertically from bottom to top, and in a circular motion horizontally.

Advantages ascribed to the attachment of the stator sleeve for closed-turbine operation include the speeding up of mixing cycles, the acceleration of chemical reaction, the emulsification of immiscible liquids, and the reduction of particle size agglomeration. In addition, the stator sleeve is said to aid in wetting out solids and blending with minimum incorporation of air. During closed-turbine mixing the material reportedly circulates evenly from bottom and sides of the mixing container to the top without vortex or surface boil.



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9-27

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**Advertisements in this section are restricted to HELP WANTED — POSITION WANTED — EQUIPMENT wanted or for sale. Rates, effective February 1, 1951; one-time, $14.00 per column inch; 13 or more times, $12.00 per column inch; Position Wanted, $4.00 per column inch. Figure 38 average words per column inch. Publisher reserves the right to reject or discontinue any classified advertisement. Replies should be addressed: Box Number ..... c/o American Dyestuff Reporter, 44 East 23rd Street, New York 10, N. Y.**

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## • OPPORTUNITIES AVAILABLE •

WANTED: TEXTILE CHEMISTS OR COLORISTS with B.S. degree preferred, with knowledge of all types of dye applications for our Dye Testing Laboratories located in the Metropolitan Area. Please send resume and salary requirements to: Personnel manager, VERONA-PHARMA CHEMICAL CORP., 169 West 52nd St., Bayonne, N. J.

WANTED: TEXTILE TECHNICIAN with laboratory experience in application and evaluation of textile finishes including resins, water repellents, etc. Should be familiar with physical testing. Knowledge of chemistry desirable but not required. Permanent position. Good opportunity. Location Northern New Jersey. Write Box No. 216

WANTED: DYE HOUSE AND LABORATORY SUPERVISOR—preferably experienced in Pile Fabric Dyeing. Our own employees are aware of this advertisement. Write Box No. 206

## • OPPORTUNITIES AVAILABLE •

WANTED: EXPERIENCED DYER for circular knit goods. All fibers, orlon and wool. Must be able to relocate to Massachusetts and on a shift basis other than days. Write Box No. 194

WANTED: ORGANIC or TEXTILE CHEMIST, B.S. or M.S. with 1-5 years experience in dyes, synthetic fibers, resins and plastics or related fields; for research on dyeing and finishing problems related to synthetic fibers. Dye experience not essential. Interesting and challenging position, excellent opportunity for professional growth. Reply in confidence to: Technical Employment, The Dow Chemical Company, Williamsburg, Virginia.

## • PERSONNEL AVAILABLE •

POSITION WANTED: CHEMICAL ENGINEER—Over 20 years experience as Chemist and trouble shooter in various piece goods dyehouses is available. Familiar with all kinds of fibres in dyeing direct vat and naphthol. Desire opportunity as supervisor or Chemist. Write Box No. 212

POSITION WANTED: TEXTILE CHEMIST, B.S. degree, over 13 years in research and development of sizing and lubrication of synthetic yarns. Excellent record of accomplishment in textured yarns, woven label, lace, hosiery, tricot, etc. In charge of textile laboratory. Write Box No. 215

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## ADR ADVERTISING INDEX

Allied Chemical Corp.
National Aniline Division ... 12, 13
Nitrogen Division
Solvay Process Division
Althouse Chemical Company
American Cyanamid Co. ... Fourth Cover
American Dyestuff Reporter ... 52, 55
American Dyewood Co., Inc.
Ansbacher-Siegle Corporation
Antara Chemicals Div., General Aniline Film Corp.
Apex Chemical Co., Inc. ... 32
Archer-Daniels-Midland Company
Arkansas Company, Inc
Arnold, Hoffman & Co., Inc. ... 29
Atlantic Refining Co., The
Atlas Electric Devices Co. ... 49

Baker Chemical Co., J. T.
Becco Chemical Division
FMC Corporation
Berkshire Color and Chemical Co.
Birch Brothers, Inc.
Burkart-Schier Chemical Co. ... 58
Butterworth & Sons Co., H. W.

Calgon Company
Campbell & Company, Inc., John
Carbic-Hoechst Corp. ... 50, 51
Carolina Fiberglass Products Co.
Chemical Products Corp.
Chlor-Alkali Division
FMC Corporation
Ciba Company, Inc. ... Front Cover
Columbia Southern Chemicals (Pittsburgh Plate Glass Co., Chemical Div.)
Crescent Chemical Company, Inc.

De Paul Chemical Co.
Dexter Chemical Corp. ... 57
Dow Corning Corp.
Du Pont de Nemours & Co., Inc., E. I.
Dyes and Chemicals Division
Electrochemicals Department, Peroxygen Products Division

Eastern Color & Chemical Co.
Eastman Chemical Products, Inc. ... 8
Emery Industries, Inc.
Emkay Chemical Co.

Fablok Mills, Inc.
Fancourt Co., W. F. ... Third Cover
Farbwerke Hoechst, A. G.
Feeley Co., E. J.
FMC Corporation
Becco Chemical Division
Chlor-Alkali Division
Foxboro Co., The

Gaston County Dyeing Machine Co.
Geigy Dyestuffs
Division of Geigy Chemical Corporation ... 6
General Aniline & Film Corp. ... 31
General Dyestuff Company ... 31
Goodyear Chemical Division
Goodrich Chemical Company, B. F.
Gross & Company, A.

Hagan Chemicals & Controls, Inc.
Hampshire Chemical Corporation
Harchem Division, Wallace & Tiernan, Inc.
Harshaw Chemical Co., The
Hart Products Corporation, The
Hercules Powder Company
Heyden Newport Chemical Corporation
Hilton-Davis Chemical Co., Division ... 10
Hoechst Chemical Corp.
Howes Publishing Company, Inc. ... 52, 55

## Heterocyclic Compounds, Vol 7

Editor: Robert C Elderfield
Published by: John Wiley & Sons Inc (June 30, 1961)
440 Park Ave South
New York 16, NY
pp: 878
Price: $37.50

"Volume 7 of 'Heterocyclic Compounds' presents the chemistry of polycyclic compounds containing two oxygen or two nitrogen atoms in different rings and the chemistry of five-and-six-membered monocyclic compounds carrying three heteroatoms, together with the benzo derivatives of the latter when such treatment appears to be warranted." The topics and authors are as follows:

1) Compounds Containing Two Hetero-oxygen Atoms in Different Rings—W Basil Whalley, University of Liverpool, England.
2) Naphthyridines—Martin J Weiss, Lederle Laboratories, and Charles P Hauser, Duke University.
3) The Carbolines—W O Kermack, University of Aberdeen, and J E McKail, University College of North Wales.
4) Phenanthrolines—W O Kermack, University of Aberdeen, and J E McKail, University College of North Wales.
5) Monocyclic Triazoles and Benzotriazoles—J H Boyer, Tulane University.
6) Oxadiazoles—J H Boyer, Tulane University.
7) The Thiadiazoles—William Sherman, Abbott Laboratories.
8) S-Triazines—Edward J Modest, The Children's Cancer Research Foundation.
9) The 1,2,4- and 1,2,3-Triazines—Jerome P Horwitz, Detroit Institute of Cancer Research
10) Oxadiazines, Thiadiazines, and Their Benzo Derivatives—Gardner W Stacy, Washington State University.

This volume upholds the tradition of the series in being up-to-date, clear and well-documented.

•

## Natural Polymer Man-made Fibres

Author: C Z Carroll-Porczynski
Published by: Academic Press Inc (May 16, 1961)
111 Fifth Ave
New York 3, NY
pp: 303
Price: $9.50

The object of this work is to give a general picture of manufacturing methods and properties of the oldest, most versatile, and most used of the man-made fibers, those based on the naturally occuring polymers. The recent developments in manufacturing methods to obtain "tailor-made" fibers fitted to specific purposes are discussed. Improvement in physical properties, such as fiber strength, toughness, resistance to abrasion and increased dimensional stability, have resulted in a whole new range of industrial applications. Recent patents are discussed and a complete international list of trade names is presented. Each chapter is accompanied by a list of references, patents, and "further readings".

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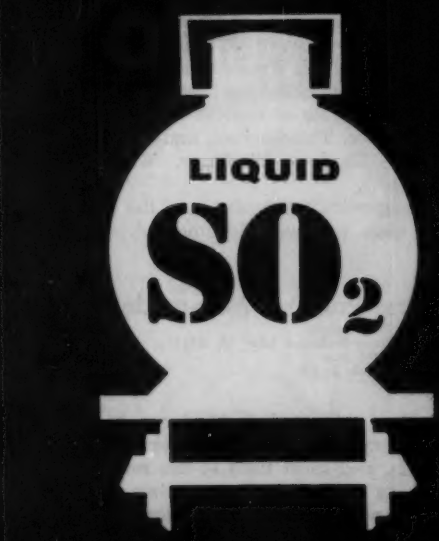


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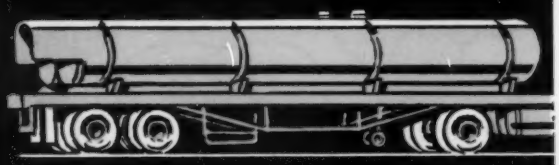

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## ADR ADVERTISING INDEX


Interchemical Corp., Color & Chemicals Division
International Salt Co.

Klauder Weldon Giles Machine Co.
Kolker Chemical Corp.
Koppers Company, Inc. 3

Laurel Soap Manufacturing Co., Inc.
Leatex Chemical Company 55
Lestoil Products, Inc.

Manufacturers Chemical Company, Inc. 52
Marbon Chemicals Div. of Borg-Warner Corp.
McCarty Aniline & Extract Co.
Metalsmiths Div., Orange Roller Bearing Co., Inc.
Moretex Chemical Products Inc. 52
Morningstar-Paisley, Inc.
Morton Salt Co.

National Aniline Division
Allied Chemical Corp. 12, 13
National Starch and Chemical Corporation
Nitrogen Division, Allied Chemical Corp.
Nopco Chemical Company
Nyanza Color and Chemical Co.

Olin Mathieson 14
Onyx Chemical Company
OPW-Jordan
Organic Chemical Corporation

Philadelphia Quartz Co.
Photovolt Corp.
Pittsburgh Plate Glass Co., Chemical Div.
Procter & Gamble
Putnam Chemical Corp.

Reading Scientific Company
Refined Products Company
Rohm & Haas Co.
Rona Pearl Corporation
Royce Chemical Company
Rudnick Representatives, Edward S.
Rumford Chemical Works

Sandox, Inc. 15, 16
Scholler Bros., Inc. 8
Seydel-Woolley & Co. 5
Shell Chemical Company
Solvay Process Division, Allied Chemical Corp.
Sou-Tex Chemical Company, Inc.
Standard Chemical Products, Inc.
Sun Chemical Company

Tanatex Chemical Corp. Second Cover
Taylor Instrument Companies
Tennessee Corporation 60
Tex-Chem Co.
Texize Chemicals, Inc.
Toshin Kogyo Co., Ltd.
Turbo Machine Company

Union Carbide Corp.

Valchem 59
Verona Dyestuffs
Virginia Chemicals & Smelting Company

Wallace & Tiernan, Inc., Harchem Division
Wallerstein Company
Watkins Salt Co.
West Indies Chemical Works, Ltd., The
Wica Chemicals, Inc. 4
Wolf & Co., Jacques

Young Aniline Works, Inc.

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Midwest Representative: Prospect Chemical Company, P. O. Box 126, Mt. Prospect, Ill.
Canadian Office: Chemtex Products, Ltd., 49 Densley Ave., Toronto 15, Ont.
Caribbean, Central and South America: A. M. Romero Corp., Empire State Bldg., New York 1, N. Y.
Australia: Paykel Bros., Ltd., 167 Missenden Rd., Newtown, Sydney
New Zealand: Paykel Bros., Ltd., P. O. Box 5046 Auckland, C. 1.

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## Light Approach Sells "WHITEST WHITES"

A recent series of cartoon ads for Calcofluor-treated fabrics have produced an enthusiastic response in textile industry merchandising circles. The cartoon series is part of an overall program of advertising support given to Calcofluor* White, Cyanamid's famous fabric brightener.

Each advertisement in the cartoon campaign features one end-use where Calcofluor White treatment gives the fabric unique sales appeal—lingerie, blouses, infants' wear, uniforms, white-ground prints.

Although the success of Calcofluor-treated merchandise is based on "whiter-than-white" eye appeal, profitable exploitation of this valuable sales feature by the trade, as well as demand from the consumer, is due in no small part to Cyanamid's consistent advertising program both in trade and consumer media.

If you would like to receive a copy of the Calcofluor White cartoon series, or technical information about Calcofluor White fabric brighteners, contact Cyanamid.

Forget those "hare-brained" promotions! To sell infants' wear faster, simply specify whitest white! Specify Cyanamid's famous fabric brightener...
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CYANAMID

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Dyes Department • Bound Brook, N. J.

## The Cumulative Effect of Iron Ions on Shade

The detrimental effect of heavy metal ions on the shade and fastness properties of dyed fabrics has been recognized for many years, but it has not been so well understood that these effects may be cumulative. One of the worst offenders is iron, because it is almost always present to some extent in dyehouse water, and because iron ions either dull the shade of most dyes or they combine with many chromable dyes to form brown or brownish-red iron complexes. In either case, the resultant fabric is off-shade and at times commercially unacceptable until expensive treatments are used to eliminate the trouble. This of course increases the costs, an extremely important factor in the textile industry at present because of the low-profit margins of textile products.

These heavy metal ions, especially those of iron, get into the dye bath in many ways. The raw water used in processing fabrics may be contaminated with iron salts before it reaches the finishing plant. When the raw water is purified by softening or distillation, it may still become contaminated as it flows through iron pipes to the processing machines. Invariably, when water is allowed to remain in supply pipes for any length of time, a certain amount of iron rust is formed. If care is not exercised, this iron is also carried into the machines, causing the familiar rust spots and blotches. Such spots are generally large enough to be seen and steps can be taken to remove them. However, in many cases the iron is so finely divided and uniformly distributed that its presence is hard to detect visually and, when acid salts are added to the treating bath, this rust dissolves to form more iron ions.

The photograph shows the change in shade of Calcochrome* Violet B dyeings on wool when the undyed wool was rinsed one to five times in water containing 3 ppm of iron ions. The outer border of wool was rinsed in distilled water. Each time the wool is rinsed in water containing iron ions the shade becomes darker. This is due to the fact that the iron complex of Calcochrome Violet B is a brown.

Recent experiments have shown that iron ions are absorbed by the textile material from an aqueous bath. They also have shown that each time wool, cotton and other materials are processed in water containing iron ions, more and more is absorbed by the fiber or fabric. Thus, the effect is cumulative and the contamination of the textile material increases. Obviously, there is one economy that the textile industry can ill afford, and that is the use of iron pipes for carrying water from storage tanks to dyeing and other processing machines.

Fortunately, there are at least two ways in which the effect of these heavy metal ions can be minimized. The more expensive method is to replace the iron pipes with stainless steel or plastic pipes, and this procedure probably would be used in building a new plant or rebuilding. A very practical and much less expensive method, however, is to use a sequestering agent such as Cyquest 40.*

For best results the Cyquest 40 should be added to the bath before the chemicals are added. The materials (fibers or fabrics) should be run in this bath for 15 to 20 minutes, after which time the chemicals and dyes are added. The lot should then be run in the dye bath for about 15 minutes before the steam is turned on. This procedure will allow the sequestering agent to react with any iron or other heavy metal ions which may be present on the fabric or in the dyes or chemicals.

The amount of sequestering agent employed should be kept at the minimum necessary for complete chelation of *only* the undesirable heavy metal ions. Any excess may partially (or completely) remove desirable metal ions from a compound containing them. This is especially true when premetalized dyes are being used for coloring fibers or fabrics.

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